30231

2-9

JPRS: 4268

14 December 1960

REPORT ON THE 1957-1959 SCIENTIFIC WORK IN SEISMOLOGY ON THE EARTH'S INTERIOR

By the Committee on Geodesy and Geophysics,
Academy of Sciences USSR

Distributed by:

OFFICE OF TECHNICAL SERVICES
U. S. DEPARTMENT OF COMMERCE
WASHINGTON 25, D. C.

U. S. JOINT PUBLICATIONS RESEARCH SERVICE
1636 CONNECTICUT AVENUE, N. W.
WASHINGTON 25, D. C.

F O R E W O R D

This publication was prepared under contract by the UNITED STATES JOINT PUBLICATIONS RESEARCH SERVICE, a federal government organization established to service the translation and research needs of the various government departments.

JPRS: 4268

CSO: 1151-S

REPORT ON THE 1957-1959 SCIENTIFIC WORK IN SEISMOLOGY ON THE EARTH'S INTERIOR

[Following is the translation of the unsigned book Soobshcheniye o nauchnykh rabotakh po seysmologii i fizike nedr zemli 1957-1959 gg., published by the Committee on Geodesy and Geophysics of the Academy of Sciences USSR, Moscow, 1960, pages 1-145.]

TABLE OF CONTENTS

Table of Contents (continued)

I. SEISMOLOGY

1. Information on Seismological USSR Organizations.

a. Scientific Research Organizations

The central scientific organization for seismological research is the Institute of Physics of the Earth (formerly the Geophysical Institute) of the Academy of Sciences USSR (Moscow).

Scientific research in this Institute is carried on in the following main fields:

The study of earthquakes occurring within the Soviet Union, with an analysis and generalization of seismic observations; compilation of seismic maps; study of the physical and geologic causes and conditions of earthquakes; study of seismic waves for devising new methods of interpretation of seismic data; study of regularities in the effect of seismic phenomena on structures; devising and carrying out methods of dividing the USSR into seismic regions; modeling of seismic processes; devising new types of seismic equipment; and study of the internal structure of the Earth from seismic data.

Research in seismology is also being carried on in affiliates of the Academy of Sciences USSR, located in seismically active provinces: The Siberian Section of the Academy (Novosibirsk); the Sakhalin Joint Scientific Research Institute (Island of Sakhalin); the Moldavian (Kishinev) and the Kola (Murmansk); and also in the Academies of the union republics (Azerbaydzhan, Armenian, Georgian, Kazakh, Kirgiz, Tadzhik, Turkmen, Uzbek, and Ukrainian). Some of these Academies have created specialized organizations, such as the Geophysics Institute of the Georgian SSR (Stalinabad); Institute of Physics and Geophysics, Turkmen SSR (Ashkhabad); Seismology Section of the Academy of Sciences Kirgiz SSR (Frunze); and Seismic Sector of the Academy of Sciences Ukrainian SSR (L'vov).

The main field of scientific research for the affiliates of the Academy of Sciences USSR and for the several organizations of the union republics' Academies is the detailed study of the seismicity of their respective regions, the study of earthquake effects, and the working out of other scientific problems in cooperation with the Institute of Physics of the Earth, Academy of Sciences USSR, and with other organizations.

Seismic research as applied to the study of volcanoes and their activity is carried on at the Volcanology Laboratory, Academy of Sciences USSR, which maintains specialized observation stations on Kamchatka.

The Moscow State University (Department of Physics of the Earth's Crust) carries on the study of the internal structure of the Earth and does research on equipment for the observation of microseismic waves.

Development of the dynamic theory of elastic waves is carried on at the Leningrad State University.

The direction and coordination of all seismic work in the Soviet Union is entrusted to the Seismology Council of the Academy of Sciences USSR.

This Council meets twice a year, to discuss the results of scientific work in seismology, to work out plans of forthcoming projects and new institutions, and to deliberate on scientific topics in the field of seismology.

Seismologists from all scientific organizations engaged in seismology usually participate in the Seismology Council meetings.

As a result of such meetings, new tasks are delineated and the work is planned and coordinated.

The Seismology Council is organizing a single method of observation at seismic stations; it also issues a manual for their staffs, and publishes a quarterly Byulleten' seti seysmicheskikh stantsiy SSSR (Bulletin of Seismic-Station Network of the USSR) and a scientific Byulleten' Soveta po seysmologii (Bulletin of the Seismology Council).

b. Seismic Stations

There is a total of 106 seismic stations in the Soviet Union. They are sponsored by various departments and organizations; their activity is coordinated by the Seismology Council, Academy of Sciences USSR.

The stations are divided into three classes: teleseismic, general, and regional.

The purpose of a few teleseismic stations is to study general seismicity and the internal structure of the Earth as well as microseismic waves of type I. The stations are equipped with B. B. Golitsin seismographs with galvanometric recording. The instrument constants are $T_1 \approx T_2 \approx 12$ sec; damping $D_1 = D_2 = 1$; maximum magnification, $V_{max} \approx 1000$.

Note here and elsewhere:

$T_1 = \frac{2\pi}{n_1}$ and $T_2 = \frac{2\pi}{n_2}$ -- vibration periods for pendulum proper and for galvanometer, respectively.

$D_1 = \frac{\varepsilon_1}{n_1}$ and $D_2 = \frac{\varepsilon_2}{n_2}$ -- damping constants for pendulum and galvanometer, respectively.

The general-type stations are designed to copy with the same problems as the teleseismic, and are also used for the study of seismicity in the USSR and the mechanism and energy of earthquakes and the structure of the earth's crust.

These stations use the D. P. Kirnos seismographs with galvanometric recording (SGK and SVK). The instrument constants are as follows: $T_1 \approx 12.5$ sec; $T_2 \approx 1.2$ sec; $D_1 \approx 0.45$; $D_2 \approx 5.0$; $\bar{V} \approx 1000$-2000 with periods of 0.25-10 sec; $\sigma^2 \leq 0.1$ (for SGK); $\sigma^2 = 0.2$"0.3 (for SVK).

The regional-type stations are for the detailed study of seismicity in individual seismic regions.

These stations are equipped chiefly with highly sensitive D. A. Kharin seismographs with galvanometric recording (GSKh and VSKh). The instrument constants are as follows: $T_1 = 0.6$-1 sec; $T_2 = 0.2$-0.4 sec; $D_1 = 0.5$-1 sec; $D_2 = 1.5$-2; $\sigma^2 \approx 0.3$; $V_{max} = 10{,}000$-$50{,}000$ with periods of 0.2-0.5 sec.

Some stations of this type are equipped with D. P. Kirnos VEGIK electrodynamic vibrographs ($T_2 = 0.6$; $D_1 = 0.5$; $T_2 = 0.06$; $D_2 = 3.0$; $\bar{V} \approx 18{,}000$; $\sigma^2 = 0.2$).

To register strong earthquakes, D. P. Kirnos SMR-2 mechanically registering seismographs are installed ($T_1 =$ $= 5.0$ sec; $D_1 = 0.45$; $\bar{V} = 7$).

For the experimental recording of surface waves, long-period seismographs are installed at some stations.

ε_1 and ε_2 -- damping coefficients for pendulum and galvanometer, respectively.

V and $\bar{V}$ -- magnification factor.

$\sigma^2 = \sigma_1 \cdot \sigma_2$ -- bond constant.

σ_1 and σ_2 -- factors characterizing the electric bond between pendulum and galvanometer, in differential equations of a seismograph with galvanometric recording.

$$\ddot{\theta} = 2\varepsilon_1 \dot{\theta} + n_1^2 \theta = -\frac{\ddot{x}}{e} + 2\varepsilon_1 \sigma_1 \psi$$

$$\ddot{\psi} + 2\varepsilon_2 \dot{\psi} + n_2^2 \psi = 2\varepsilon_2 \sigma_2 \dot{\theta}$$

θ and ψ --- angular deflections of pendulum and the galvanometer frame from the equilibrium position; x is the ground shift.

Table

Station Name	Sponsoring Organization	Geographic Coordinates N	E°	Instrument Make
1	2	3		4
Moscow	Inst. of Physics of the Earth	55°44'	37°38'	Golitsin and Kirnos
Abastumani	Geophysical Inst. AS (Academy of Sciences) Georgian SSR	41 45	42 50	Kharin
Alma-Ata	Inst. of Physics of the Earth	43 16	76 57	Kirnos (galvanom. and mech. recording)
Alma-Ata 2	"	43 16	77 23	Kirnos and Kharin
Alushta	"	44 42	34 25	Kharin
Andizhan	"	40 45	72 22	Kirnos (galvanom. and mech. recording)
Apatity	Kola Affiliate, AS USSR	67 33	33 26	Kirnos and Kharin
Aurakhmat	Inst. of Physics of the Earth	41 35	70 07	Kirnos vibrograph
Akhalkalaki	Geophysical Inst., AS Georgian SSR	41 24	43 29	Kharin
Ashkhabad	Inst. of Physics and Geophysics, ASTurkmen SSR	37 57	58 21	Kirnos (galvanom. and mech. recording)
Bayram-Ali	Inst. of Physics of the Earth	37 36	62 07	Kirnos
Baku	Inst. of Physics of the Earth	40 23	49 54	Golitsin and Kirnos
Bakuriani	"	41 44	43 31	Kharin and Kirnos
Bogdanovka	Geophysical Inst., AS Georgian SSR	41 16	43 36	Kharin
Borzhomi	"	41 50	43 23	Kirnos
Vannovskaya	Inst. of Physics and Geophysics, AS Turkmen SSR	37 57	58 06	Kirnos vibrograph
Vladivostok	Inst. of Physics of the Earth	43 07	131 54	Kirnos
Gal'va-Say	"	41 32	69 54	Kirnos vibrograph
Garm	"	39 00	70 19	Kirnos
Gegechkori	Geophysical Inst., AS Georgian SSR	42 21	42 23	Kharin

Table (continued)

1	2	3	4
Gissar	Inst. of Seismic-Resistant Construction and Seismology, AS Tadzhik SSR	38 28 68 34	Kirnos vibrograph
Gori	Geophysical Inst., AS Georgian SSR	41 59 44 07	Kirnos
Goris	Inst. of Physics of the Earth	39 30 46 20	Kirnos Kharin
Gornyy	"	44 56 147 34	Kirnos vibrograph
Groznyy	"	43 19 45 42	Kirnos
Dzhafr	"	39 06 70 35	Kirnos vibrograph
Dzhergetal	"	39 13 71 14	Kirnos Kirnos vibrograph
Dusheti	Geophysical Inst., AS Georgian SSR	42 05 44 42	Kharin
Yerevan	Inst. of Physics of the Earth	40 11 44 30	Kirnos
Zimchurud	Inst. of Seismic-Resistant Construction and Seismology, AS Tadzhik SSR	38 46 68 38	Kirnos vibrograph
Zugdidi	Geophys. Inst., AS Georgian SSR	42 31 41 53	Kharin
Ili	Inst. of Physics of the Earth	43 55 77 06	Kharin
Irkutsk	Siberian Affiliate, AS USSR	52 16 104 19	Golitsin and Kirnos
Ishtion	Inst. of Physics of the Earth	38 50 70 47	Kirnos vibrograph
Kabansk	Siberian Affiliate, AS USSR	52 03 106 39	Kirnos
Kara-Su	Inst. of Seismic-Resistant Construction and Seismology, AS Tadzhik SSR	38 29 68 59	Kirnos vibrograph
Kizil-Arvat	Inst. of Physics of the Earth	39 12 56 16	Kirnos
Kirovabad	"	40 39 46 20	Kirnos and Kharin
Kishinev	Moldavian Affiliate, AS USSR	47 01 28 50	Kirnos

Table (continued)

1	2	3	4
Klyuchi	Volcanology Laboratory USSR	56 19 160 52	Kirnos
Kosmodem'yansk	Sakhalin Joint Institute (Sakhalin Island), AS USSR	44 06 145 53	Kirnos vibrograph
Krasnaya Polyana	Inst. of Physics of the Earth	43 40 40 12	Kirnos vibrograph
Kulyub	Inst. of Seismic-Resistant Construction and Seismology, AS Tadzhik SSR	37 54 69 45	Kirnos (galvanom. and mech. recording
Kuril'sk	Sakhalin Joint Institute, AS USSR	45 14 147 52	Kirnos
Kurmenty	Inst. of Physics of the Earth	43 00 78 17	Kharin
Kyakhta	Siberian Affiliate, AS USSR	50 22 106 27	Kirnos
Leninakan	AS Armenian SSR	40 46 43 51	Inst. of Seismology, AS USSR
Lenkoran'	Inst. of Physics of the Earth	38 46 43 51	Nikiforov
Lunacharskoye	Inst. of Mathematics and Mechanics, AS Uzbek SSR	41 20 69 21	Kirnos
L'vov	Seismic Sector, AS Ukrainian SSR	49 49 24 02	Kirnos
Magadan	Main Geol. Admin. RSFSR	59 33 150 48	Kirnos
Makhachkala	Inst. of Physics of the Earth	42 58 47 30	Kirnos
Mirnyy	Antarctic Expedition, AS USSR	66 33 93 00	Kirnos
Muskinabad	Inst. of Physics of the Earth	38 41 69 39	Kirnos vibrograph
Murgab	"	38 22 73 56	Kirnos
Namangan	"	40 59 71 40	Kirnos
Naryn	"	41 26 75 59	Kirnos
Nakhichevan'	"	39 12 45 24	Kirnos
Lesozavodsk	"	44 46 147 11	Kirnos vibrograph
Napay	"	41 43 70 07	Kirnos vibrograph

Table (continued)

1	2	3	4
Nurek	Inst. of Seismic-Resistant Construction and Seismology, AS Tadzhik SSR	38 24 69 20	Kirnos vibrograph
Ob-Garm	"	38 43 69 43	Kirnos (galvanom. and mech. recording)
Okha	Sakhalin Joint Institute, AS USSR	55 33 142 56	Kirnos
Petropavlovsk na Kamchatke	Inst. of Physics of the Earth	53 01 158 39	Kirnos (galvanom. and mech. recording)
Przheval'sk	"	42 29 78 24	Kharin
Pulkovo	"	59 46 30 19	Golitsin and Kirnos
Pyatigorsk	"	44 02 43 04	Kirnos
Rakhov	Seismic Sector, AS Ukrainian SSR	47 56 24 10	Kharin
Rybach'ye	Inst. of Physics of the Earth	42 27 76 11	Kirnos
Samarkand	Inst. of Mathematics and Mechanics, AS Uzbek SSR	39 40 66 59	Kirnos
Sverdlovsk	Inst. of Physics of the Earth	56 50 60 38	Golitsin Kharin
Severo-Kuril'sk	Sakhalin Joint Institute, AS USSR	50 40 156 06	Kirnos
Semipalatinsk	Inst. of Physics of the Earth	50 24 80 15	Kirnos
Simferopol'	"	44 57 34 07	Kirnos Kharin
Sochi	"	43 35 39 43	Kirnos
Stalinabad	Inst. Seismic-Resistant Construction and Seismology, AS Tadzhik SSR	38 34 68 46	Kirnos (galvanom. and mech. recording), Nikiforov, Kirnos vibrograph, Kharin
Stepanavan	AS Armenia SSR	41 00 44 23	Kharin

Table (continued)

1	2	3	4
Sultan-Mazar	Inst. of Physics of the Earth	38 28 70 04	Kirnos vibrograph
Tavil'-Dara	"	38 41 70 29	Kirnos vibrograph
Tashkent	"	41 20 69 18	Golitsin Kirnos (mech. rec.)
Revdovoye	Sakhalin Joint Inst., AS USSR	45 16 148 02	Kirnos vibrograph
Tbilisi	Geophysical Inst., AS Georgian SSR	41 43 44 48	Golitsin
Tiksi	Inst. of Physics of the Earth	71 38 128 52	Kirnos Kharin
Turbat	"	41 44 69 39	Kirnos vibrograph
Uglegorsk	Sakhalin Joint Institute, AS USSR	49 05 142 04	Kirnos
Uzhgorod	Seismic Sector, AS Ukrainian SSR	48 38 22 18	Kharin
Fabrichnaya	Inst. of Physics of the Earth	43 08 76 26	Kharin
Feodosiya	"	45 01 35 23	Kirnos
Ferghana	"	40 23 71 47	Kirnos
Frunze	"	42 50 74 37	Kirnos
Kheys	Armenian-Azerbaydzhan Scientific Research Inst.	80 37 58 03	Kirnos vibrograph
Khodzhikent	Inst. of Physics of the Earth	41 37 69 58	Kirnos vibrograph
Kherog	"	37 29 71 32	Kirnos (galvanom. and mech. recording)
Khorongon	Inst. of Seismic-Resistant Construction and Seismology, AS Tadzhik SSR	38 40 68 47	Kirnos
Chernovtsy	Chernovtsy State Univ.	48 17 25 56	Nikiforov
Chernovtsy-2	Seismic Sector, AS Ukrainian SSR	48 18 25 56	Kirnos
Chilik	Inst. of Physics of the Earth	43 34 78 25	Kharin
Chimkent	"	42 19 69 36	Kirnos

Table (continued)

1	2	3	4
Chusal	Inst. of Physics of the Earth	39 06 70 46	Kirnos vibrograph
Chuyan-Garon	"	38 39 69 10	Kirnos vibrograph
Shemakha	"	40 38 48 38	Kirnos
Yuzno-Sakhalinsk	Sakhalin Joint Inst., AS USSR	47 01 142 43	Kirnos
Yakutsk	Yakutsk Affiliate, AS USSR	62 01 128 43	Kirnos
Yaldymych	Inst. of Physics of the Earth	39 04 70 27	Kirnos vibrograph
Yalta	"	44 30 34 10	Kirnos (mec. rec.) Kharin
Shikotan	"	43 52 146 49	Kirnos vibrograph

II. GENERAL INFORMATION ON SEISMIC WORK

In the current period, seismic work proceeded along the lines set forth in the preceding period (see Soobshcheniye o nauchnykh rabotakh po seysmologii i fizika nedr zemli /Communication on Scientific Work in the Field of Seismology and Physics of the Earth/ Academy of Sciences USSR Publishing House, Moscow, 1957). Specific data on the results for the current period can be obtained from the bibliography appended. The research can be subdivided into the following groups:

1. Study of seismicity and an analysis of seismic observations;
2. The Earth's structure from seismic data;
3. Conditions and causes of earthquakes;
4. Seismic differentiation of regions and seismic resistance of structures;
5. Theoretical and experimental study of seismic waves;
6. Seismic equipment;
7. Microseisms. Tsunami.

General information on the results obtained in these fields is given below.

The study of seismicity consists of the study of the regional distribution of earthquakes and of devising and developing methods of study in seismicity, chiefly of individual regions, on the basis of more precise and detailed instrument observations and from geologic (tectonic) data. Considerable attention was paid to evaluation of the intensity of earthquakes on the conventional M scale and by determining the energy flux in oscillations.

The current years have witnessed a study of the geologic structure and the field of weak aftershocks of pleistoseismic provinces of some strong earthquakes in Central Asia, the Caucasus, the Far East, and Eastern Siberia. The purpose of this work was a more detailed knowledge of seismic activity in areas of strong earthquakes, which is essential for a more precise differentiation into seismic areas, for earthquake-damage prevention and for a determination of the conditions and causes of earthquakes.

In addition, data from many years of earthquake observations at seismic stations of the Soviet Union (the Caucasus, Kuriles-Kamchatka zone, Central Asia, etc.) were summarized and analysed in the light of the intensity of earthquakes and of tectonic data, which is important for revealing the relationship between earthquakes and the structural features of the Earth's crust.

Following the schedule of the International Geophysical Year, the USSR carried on a study of seismicity of the Arctic

and participated in the study of seismicity of the Antarctic and its ice pack. The data from the Arctic seismic stations were used in locating the epicenters of Arctic earthquakes along the Lomonosov Range.

In analyzing the seismic data, emphasis was placed on the development of methods of determining earthquake foci and on means of determining their intensity from instrumental data. This is necessary in connection with the generalization of data from the network of seismic stations in the USSR, having as its final goal the more precise seismic differentiation of the country. New time-distance curves have been constructed of a regional character, which permit the more precise determination of the eartquake foci.

A systematic analysis of data from all seismic stations in the USSR -- with its results, the coordinates of foci, and the intensity of earthquakes -- was published in the quarterly bulletin of the USSR seismic network by the Seismology Council. In connection with the growing network of seismic stations, the number of recorded earthquakes has grown considerably, reaching 16,000 in 1959.

In the field of study of the causes and conditions of earthquakes, research has been conducted along the lines of determining forecasting criteria and of studying earthquake foci and the geological criteria of seismicity.

Progress was made in the study of stresses and the nature of displacements in earthquake foci on the basis of the theory of disturbances. It has been established that earthquakes in the area of Hindukush and the northwestern Pacific island arcs are related to compressive horizontal stresses. General conclusions have been arrived at from the study of the earthquakes' foci through their representation by concentrated sources.

In order to get insight into possible processes taking place in earthquake foci, a study has been carried out of the break in continuity of rocks on laboratory models and through a study of folding and faulting dislocations in the Earth's crust in the several active seismic zones of the Soviet Union.

A study of seismic conditions in the Garm and Stalinabad areas of the Tadzhik SSR has yielded preliminary data on the possibility of studying the seismic conditions during strong earthquakes.

The study of the Earth's structure from seismic data includes a study of its deep interior as well as of its crust. The last two years witnessed the development and broad application of the deep seismic sounding method, based on the correlation of waves refracted and reflected by the divisions of the Earth's crust.

Extensive work in deep seismic sounding has been done in the transitional zone from the Asian continent to the Pacific. Regions of the Earth's crust of different types have been isolated: the oceanic, the continental, and the transitional. It has been shown that the transition from the Sea of Okhotsk to the continent in the Magadan area is accompanied by a sharp plunge of the Mohorovicic division.

The structure of the Earth's crust in Eurasia and the Arctic Ocean has been studied from data on the velocity of propagation and dispersion of Rayleigh and Love waves.

A study of the amplitude range of seismic waves has shown that the low-velocity layer is at least 200-km deep and has a fairly definite boundary. A study of the amplitudes of compressional and polarized seismic waves, and a modeling of foci in accordance with the disturbance theory, have shown the presence in the Earth's crust of layers causing birefringency.

The study of seismic waves was both theoretical and experimental. The theoretical study was chiefly of waves propagating in plane-stratified media. Emphasis was placed on studying the nature of refracted waves. As a result, formulas were obtained determining the oscillation nature of refracted waves as a function of parameters of a stratified medium. Considerable attention was given to the study of interference waves (surface waves in a stratified medium), with general theoretical results obtained for waves in the presence of axially symmetrical sources. Deserving of notice among experimental works is research on the absorption of energy of seismic waves due to imperfect elasticity. The waves' propagation was studied on a model by means of ultrasonic impulse installations and by using the stroboscopic method, with special attention paid to a model study of refracted and surface waves.

The work on seismic differentiation and seismic resistance of structures was developed chiefly in response to practical demands. The main effort was directed toward a further refinement of seismic differentiation of the Soviet Union on the basis of a study of the most recent tectonics throughout the USSR, observations at field and general-type seismic stations, and instrument observations. As a result, a new and improved seismic-differentiation map of the USSR has been compiled. In refining seismic-differentiation maps considerable attention was paid to the study of the mobility of individual segments of the Earth's crust separated by deep-seated faults.

A study was initiated of statistical regularities in the reoccurrence of earthquakes within the broad range of the seismic energy of their foci, beginning with weaker and more frequent ones. The purpose of this work, carried on chiefly in Central Asia, is to devise better qualitative

methods of seismic differentiation, with a quantitative evaluation of seismic activity as determined by the average recurrence of destructive earthquakes.

The work of micro-differentiation into seismic areas was continued; its main purpose is to determine the effect of geologic structure and the nature of ground on the intensity and the character of oscillations in areas of contemplated construction. Work in this field was carried out in strong earthquake zones in the Caucasus, with special field instrument observations made for this purpose. The physical base for such micro-differentiation was the data on oscillations under various geologic conditions and with a different ratio of the wave length to the thickness of sedimentary rocks.

In developing the methods of designing earthquake-proof buildings, the statistically typical range of vibrations was studied simultaneously for the foundation and for different points of a building during earthquakes. A number of projects were designed to develop a theory for seismic-resistant structures.

The work of designing new equipment was concentrated on the development of seismographs recording the ground vibration in a wide range of periods, with their constant increase; also devices recording very weak proximate earthquakes. A new type of equipment has been worked out to measure small inclinations of the surface and to record vibrations during strong earthquakes. Work is in progress on direct recording of the energy of seismic waves.

The study of microseisms was carried on to determine the relationship between their sources -- cyclones and storms in oceans and seas -- and the intensity of their field as observed at permanent seismic stations and at triple microseismic stations, affording a direction determination for the microseism source. In the MIT period, six triple microseismic stations have been set up. Three of them (Vyborg, Murmansk, and Barentsburg) were to observe the Atlantic microseisms, and three (Yuzhnyy Sakhalinsk, Petropavlovsk, and Vladivostok) to watch the northeastern Pacific. The difficulties involved in this setup made it imperative to improve the method of determining the position of a source from observations at distant seismic stations. With this in mind, the effect of different oceanic depths on the phase velocity of short period Rayleigh waves was studied, and a method of evaluating the refraction of the microseism propagation path in the ocean has been evolved.

A model with the ultrasonic seismoscope was used for determining the effect of surface relief, such as in Scandinavia, on the intensity of microseisms in their propagation from the Atlantic to continental seismic stations. It has been shown that the maximum microseism absorption occurs when its path crosses fjords at about 45°.

In the field of tsunami, the effort during the current period was concentrated on the warning service against the appearance of tsunami on the Kurile-Kamchatka coast during strong earthquakes out in the ocean. Special rapid-action seismic equipment has been designed and built for this purpose, which makes it possible to determine in a few minutes the epicenter of a strong earthquake. Such equipment has been installed at Petropavlovsk, Yuzhno-Sakhalinsk, and Kuril'sk. For greater certainty in forecasting the appearance of a tsunami during an earthquake out in the ocean, a map has been compiled from an analysis of past earthquakes of those zones most affected by tsuname waves during strong earthquakes. This map shows stretches of the coast which are most and least dangerous because of tsunami on the basis of geomorphological and other data. For an operational determination of the possibility of tsunami from the instrument data on the epicenter position and the intensity of an earthquake, a Japanese-type diagram has been constructed for tsunami forecasting on the basis of distance from the epicenter and the amplitude as recorded on a seismogram.

Material on the 4-5 November 1952 tsunami has been analyzed. It shows that the average height of tsunami waves along a 1,000-km stretch of the Kurile-Kamchatka coast, from Ust'-Kamchatsk to the Maua Island, attained 7-8 m. A maximum height of about 20 m was recorded on Paramushir Island. Certain relationships between the coast line, coastal relief, and the height of the tsunami wave has been established.

BIBLIOGRAPHY

1. Study of Seismicity and Analysis of Seismic Observations

1. Abdullayev, R. A., "Determination of Average Velocity From Time-Distance Curves of Refracted Waves," Trudy Azerb. industr. inst., Issue 18, 1958, pp 135-142.

2. Abdullayev, R. A., "Two Graphic Methods of Determining the Effective Velocity from Time-Distance Curves of Reflected Waves," Ibid., Issue 19, 1957, pp 48-57.

3. Aronovich, Z. I., "Errors in the Coordinate Determination of Crimean Earthquakes," Izvestiya AN SSSR, ser. geofiz., No 2, 1958, pp 255-259.

4. Arkhangel'skaya, V. M., "Use of Recordings of Surface Waves in the Interpretation of Seismograms," Byull. soveta po seismologii, No 6, 1957, pp 81-88.

5. Bagdasarova, A. M., Isnamov, K. Sh., Koridalin, Ye. A., Kuznetsov, V. P., Kuz'mina, N. V., Nenilina, V. S., Nekrasov, I. L., Sultanova, Z. Z., and Kharin, D. A., "Seismicity of the Eastern Part of Southern Spurs of the Main Caucasian Range and Some Methodological Problems of the Seismicity Study of Individual Areas," Soobshcheniye I. Izv. AN Azerb. SSR, ser. geol-geogr. nauk, No 6, 1959.

6. Bichevina, V. N., "Determination of Seismic Elements From Regional Instrument Observations (on material from Central Asia)," Soobshch. Sakhalinskogo kompleksn. nauchno-issled. inst. (AN SSSR), Issue 5, 1957, pp 72-86.

7. Bugaylo, V. A., "Rapid Method of Constructing Reflecting Boundaries by the Intersection Method," Tr. gorno-geol. inst. (Ural'sk. filial AN SSSR), Issue 30, geofiz. sborn., No 2, 1957, pp 142-145.

8. Bune, V. I., "Experiment in the Use of Energy Characteristics in the Study of Seismicity of Tadzhikistana," Izv. otd. yestestv. nauk (AN TadzhSSR), No 23, 1957, pp 19-34.

9. Butovskaya, Ye. M., Ulomov, V.I., and Yakovlev, V. N. "Initial Experiments in Recording of Seismic Effects in Explosions Under the Uzbekistan Ground Conditions," Izv. AN UzbSSR, ser. fiz. mat. nauk, No 3, 1957, pp 79-85.

10. Byus, Ye. I., "Status of Seismic Knowledge of the Caucasus," Tr. inst. geofiz. AN Gruz SSR, Vol 17, 1958, pp 95-120.

11. Vasil'yeva, L. B., "The 1953 Earthquake in the Gissar Valley," Izv. otd. yest. nauk (AN Tadzh SSR), No 22, 1957, pp 3-15.

12. Vasil'yeva, L. B., "The Stalinabad Earthquake, 27 February, 1952," Ibid., No 1, 1958, pp 63-71.

13. Vvedenskaya, N. A., "Time Relationship Between Changes in Seismicity for Proximate Epicentral Zones," Izv. AN SSSR, ser. geofiz., No 11, 1958, pp 1394-1398.

14. Vvedenskaya, N. A. and Fogel', A. A., "The Epicenter Map of Northern Tien-Shan," Byull. sovyeta po seismologii, No 3, 1957, pp 106-117.

15. Veytsman, P.S., "Correlation of Seismic Waves in Deep Seismic Sounding of the Earth's Crust," Izv. AN SSR, ser. geofiz., No 12, 1957, pp 1438-1452.

16. Gayskiy, V. N., "Precision in the Angle Determination By Means of an Azimuth Measuring Device With Inclined Seismographs," Tr. AN Tadzh SSR, Vol 71, 1957, pp 39-45.

17. Gal'perin, Ye. I., "A Method for Observing Spatial Soundings," Prikladnaya Geofizika, Issue 17, 1957, pp 67-75.

18. Gamburtsev, G. A., "Some New Methods of Seismic Study," Izv. AN SSSR, ser. geofiz., No 12, 1957, pp 1431-1437.

19. Gzovskiy, M. V., Krestnikov, V. N., Nekrasov, I. L., and Reysner, "Correlation of Tectonics and Seismicity of the Garm Area, Tadzhik SSR," Ibid., No 8, 1958, pp 959-976.

20. Glivenko, Ye. V., "Evaluation of Precision in Determining the Earthquake Hypocenters," Ibid., 1959, No 4, 1959, pp 527-537.

21. Glivenko, Ye. V., "Determination of the Quantity Measured in Seismic Problems, from Excess Observations," Ibid., No 7, 1959, pp 981-987.

22. Glotov, O. K., "On the Effect of Refraction at Division Boundaries in Interpreting the Time-Distance Curves for Refracted and Reflected Waves," Prikladnaya fizika, Issue 16, 1957, pp 114-129.

23. Golenetskiy, S. I., "Determination of the Prime Ordinate and a Method of Epicentral Construction for Linear Time-Distance Curve," Tr. AN Tadzh SSR, Vol 71, 1957, pp 29-37.

24. Grin, V. P., "The Problem of Epicentral Zones," Tr. yubil. nauch. sessii AN Kirghiz SSR, 1958, pp 362-371.

25. Grin, V. P., O Seismichnosti Kok-Shaala (Seismicity of Kok-Shaal), Frunze, 1958.

26. Dzhibladze, E. A., "Earthquakes in the Greater Caucasus," Tr. Inst. Geofiziki (AN Gruz. SSR), Vol 16, 1957, pp 103-114.

27. Ikramov, M. I., Natematicheskov Statistiki (Study of Seismicity in Uzbekistan by Methods of Mathematical Statistics), Tr. Uzbek. Univ., Issue 74, 1957, pp 119-138.

28. Kazanli, D. N., "Geology of Northern Tien-Shan in Connection with its Seismicity," Byull. soveta po seismol., No. 3, 1957, pp 53-80.

29. Kirillova, I. V., "Periodicity of Destructive Earthquakes in the Caucasus and Turkey," Doklady AN SSSR, Doklady AN SSSR, Vol 115, No 4, 1957, pp 771-773.

30. Kirnos, D. P. and Kondorskaya, N. V., "Determination of Amplitudes for First Arrival of Seismic Waves," Izv. AN SSSR, ser. geofiz., 1958, No 12, pp 1443-1450.

31. Kolosenko, M. N., "Effect of Ellipsoidality of the Earth in the Determination of Epicentral Distances," Ibid., No 1, 1958, pp 116-120.

32. Kondorskaya, N. V., "Correctinns to the Jeffreys-Bullen Time-Distance Curve," Byull. sov. po seismologii, No 6, 1957, pp 71-75.

33. Kondorskaya, N. V., "Some Regional Features Affecting the Propagation Time of Seismic Waves," Izv. AN SSSR, ser. geofiz., 1957, No 7, pp 895-913.

34. Kondorskaya, N. V. and Postolenko, G. A., "Seismicity of the USSR for 1955," Ibid., No 2, 1957, pp 255-257.

35. Kondorskaya, N. V. and Postolenko, G. A., "Seismic Activity in the Kurile-Kamchatka Province in 1954-1956," Ibid., No 9, 1958, pp 1114-1120.

36. Kondorskaya, N. V. and Postolenko, G. A., "An Analysis of Observations of the Kurile-Kamchatka Province Earthquakes," Ibid., No 10, 1959, pp 1448-1454.

37. Kon'kov, A. A., "Strong Earthquakes of the Stalinabad Area and Adjacent Provinces," Uchen. zapiski (Kulyabskiy ped. inst.), Issue 3, 1957, pp 257-268.

38. Korovnichenko, Ye. G., "Velocities and Depths as Determined with Joint Use of Time-Distance Curves for the Purely Compressional and for One of the Interchangeable Types of Refracted Waves," Tr. inst. geolog. nauk (AN Ukr SSR), ser. geofiz., Issue 2, 1958, pp 120-129.

39. Kuznetsov, V. P., "The Baku Earthquake 28 November, 1958," Dokl. AN Azerb SSR, 1959, Vol 15, pp 699-703.

40. Kurditskaya, A. A. and Nepesov, R. D., "On the Seismicity of Turkmenia, Tr. inst. fiz. i geofiz. (AN Turkm SSR), Vol 5, 1958, pp 89-117.

41. Kukhtikova, T. I., "The Problem of Correlation of Seismic and Geologic Data," Tr. (AN Tadzh SSR), Vol 71, 1957, pp 21-28.

42. Kukhtikova, T. I., Gayskiy, V. N., and Bune, V. I., "Seismicity of Tadzhikstan in 1955," Ibid., pp 3-19.

43. Lebedeva, T. M., "Earthquakes in the Caucasus with Foci Below the Earth's Crust," Tr. inst. geofiz. (AN Gruz SSR), Vol 17, 1958, pp 139-159.

44. Levitskaya, A. Ya. and Muratov, M. V., "Relationship Between Seismicity and Tectonic Structure of the Black Sea Trough and the Surrounding Provinces," ser. geofiz., No 4, 1959, pp 538-545.

45. Leonov, N. N., "The 1955 Ulugchatsk Earthquake," Ibid., No 11, 1959, pp 1708-1713.

46. Neprochnov, Yu. P., "Results of Seismic Study of the Black Sea in the Anapa Area," Dokl. AN SSSR, Vol 21, No 6, 1958, pp 1001-1004.

47. Oganisyan, Sh. S., "Relationship of Gravity Anomalies with Seismicity," Dokl. AN Armen SSR, Vol 26, No 2, 1958, pp 77-80.

48. Panasenko, G. D., "Seismicity in the Kola Peninsula and Northern Karelia," Izv. AN SSSR, ser. geofiz., No 8, 1957, pp 969-978.

49. Papalashvili, V. G., "Time-Distance Curve for Seismic Waves in the Caucasus, in Earthquakes With Near-Surface Epicenters," Ibid., No 7, 1959, pp 1052-1054.

50. Pasechnik, I. P., "Air Waves Originating in the Gobi-Altai Earthquake, 4 December, 1957," Ibid., ser. geofiz., No 11, 1959, pp 1687-1689.

51. Pataraya, E. I., "The Gomarets Earthquake, 11 June 1954," Tr. inst. geofiziki (AN Gruz SSR), Vol 16, 1957, pp 129-133.

52. Puchkov, S. V., Solonenko, V. P., Treskov, A. A., and Florensov, N. A., "New Strong Earthquake in Eastern Siberia," Izv. sib. otd. AN SSSR, No 3, 1958, pp 42-51.

53. Puchkov, S. V. and Khovanova, R. I., "The Kyrensk Earthquake, 10 August 1958," Izv. AN SSSR, ser. geofiz., No 6, 1959, pp 891-894.

54. Rezanov, I. A., "The 1948 Ashkhabad Earthquake and the Geologic Conditions of Its Origin," Ibid., No 6, 1958, pp 713-728.

55. Riznichenko, Yu. V., "Methods of Mass Determination of Foci for Proximate Earthquakes and of Velocities of Seismic Waves in the Foci Area," Ibid., No. 4, 1958, pp 425-437.

56. Riznichenko, Yu. B., "On the Study of Seismic Conditions," Ibid., No 9, 1958, pp 1057-1074.

57. Rozova, Ye. A., "Seismicity of Central Asia," Byull. sov. po seismologii, No 6, 1957, pp 36-42.

58. Rozova, Ye. A., "Seismic Activity in Kirghisia," Tr. AN Kirgh SSR, otd. seism., 1959, pp 3-28.

59. Rustanovich, D. N., "Some Problems in the Study of Seismicity in the Ashkhabad Area," Izv. AN SSSR, ser. geofiz., No 1, 1957, pp 10-20.

60. Rustanovich, D. N., "Preliminary Results of Instrument Study of Seismicity in Krasnaya Polyana Earthquakes," Byull. sov. po seismologii, No 5, 1958, pp 55-62.

61. Savarenskiy, Ye. F., "On the Study of Seismicity of the USSR," Ibid., No 6, 1957, pp 16-18.

62. Solov'yev, P. A., "An Earthquake in Central Yakutiya," Izv. AN SSSR, ser. geofiz., No 12, 1957, pp 1507-1509.

63. Solov'yev, S. L., "Relationship of the Energy of Spherical Waves and the Earthquake Intensity," Byull. soveta po seismologii , No 6, 1957, pp 109-121.

64. Solov'yev, S. L., "The North Baikal Earthquake, 29 April 1917," Izv. AN SSSR, ser. geofiz., No 4, 1959, pp 536-542.

65. Solov'yev, S. L. and Shebalin, N. V., "Determination of the Intensity of an Earthquake by the Ground Displacement in Surface Waves," Ibid., No 7, 1957, pp 926-930.

66. Solov-yev, S. L. and Shein, V. B., "Intensity of Earthquakes from Data Obtained at Far East and Continental Stations of the USSR," Ibid., No 9, 1959, pp 1375-1385.

67. Solonenko, V. P., "An Earthquake in the Gobi-Altai, 4 December 1957," Izv. AN SSSR, ser. geolog., No 7, 1959, pp 32-39.

68. Solonenko, V. P., Treskov, A. A., Florensov, N. A., and Puchkov, S. V., "The Muysk Earthquake, 27 June, 1957," Tr. inst. fiz. zemli (AN SSSR), No 1 (168), Issue 1, 1958, pp 29-43.

69. Sultanova, Z. Z., "Analysis of Observations of the Azerbaidzhan Earthquakes," Izv. AN SSR, ser. geofiz., No 3, 1958, pp 398-404.

70. Sultanova, Z. Z., "On the Applicability of the Isoline Method," Dokl. AN Azerb. SSR, Vol 14, No 6, 1958, pp 429-432.

71. Sultanova, Z. Z., "The Isoline Method," Izv. AN SSR, ser. geofiz., No 5, 1959, pp 744-747.

72. Tamraz'yan, G. P., "Some Features of the Tadzhikistan Earthquakes," Dokl. AN Tadzh. SSR, Vol 1, No 1, 1958, pp 25-31.

73. Tamraz'yan, G. P., "Seismic Activity in the North-western Pacific Fringe," Izv. AN SSSR, ser. geofiz., No 5, 1958, pp 664-668.

74. Tvaldtvadze G. K. and Kartsivadze, G. Ye., "New Data on the Distribution of Epicenters and Hypocenters of the Caucasian Earthquakes," Tr. inst. geofiz. (AN Gruz SSR), Vol 16, 1957, pp 163-175.

75. Tokarev, V. A., "Seismicity of the Barentz Sea Region," Tr. Leningr. ob. yestestvoispytateley, Vol 69, Issue 2, 1957, pp 194-203.

76. Tokarev, V. A., "Geological Interpretation of Seismicity in the Kola-Scandinavia Region," Dokl. AN SSSR, Vol 119, No 4, 1958, pp 772-775.

77. Yokmulin, M. Kh., "Determination of Position of Epicenter of a Proximate Earthquake with its Focus in the Earth Crust," Tr. yubil. sessii AN Kirgh. SSR, 1958, pp 373-388.

78. Treskov, A. A., "Differential Method of Determining the Focus Depth for a Proximate Earthquake," Izv. AN SSSR, ser. geofiz., No 4, 1958, pp 543-549.

79. Trubenko, V. F., "The Dyurbel'dzhin Earthquake, 3 December 1954," Tr. AN Kirgh. SSR, otd. seism., 1959, pp 51-60.

80. Florensov, N. A., "A Catastrophic Earthquake in the Gobi Altai," Priroda, No 7, 1958, pp 73-77.

81. Tskhakaya, A. D., "Seismic Activity and the Work of Seismic Stations in the Caucasus, in 1954-1955," Izv. AN SSSR, ser. geofiz., No 6, 1957, pp 785-788.

82. Tskhakaya, A. D., "The Gegechkory Earthquakes, 6 January 1957," Ibid., No 8, 1953, pp 990-999.

83. Tskhakaya, A. D., "Seismicity of the Dzhavakhet (Akhalkaly) Highlands and the Adjacent Areas," Tr. inst. geofiziki (AN Gruz. SSR), Vol 16, 1957, pp 177-219.

84. Tskhakaya, A. D. and Maysuradze, O. M., "The Achigvar Earthquake, 5 June 1958," Izv. AN SSSR, ser. geofiz., No 9, 1959, pp 1386-1392.

85. Tskhakaya, A. D. and Sikharulidze, D. I., "Seismicity of the Sochi Area and the Krasnaya Polyana Earthquakes, 22 and 27 December 1955," Soobshch. AN Gruz. SSR, Vol 18, No 3, 1957, pp 287-292.

86. Tskhakaya, A. D. and Sikharulidze, D. I., "An Earthquake in Upper Megrelia, 25 December 1955," Ibid., Vol 20, No 1, 1958, pp 27-34.

87. Shan'gin, N. V., "Experiment in Utilization of Damping of Seismic Waves," Uchen. zap. Leningr. univ., No 249, ser. fiz. i geol. nauk., Issue 10, 1958, pp 261-277.

88. Yakovleva, O. A., "A Manuscript Chronicle of the 1626 Earthquake in the North of the Moscovite State," Izv. AN SSSR, ser. geofiz., No 3, 1958, p 423.

2. The Earth's Structure From Seismic Data.

1. Andreyev, S. S., "Study of Deep Structure of the Earth's Crust by Means of PS Interchangable Waves Registered During Earthquakes," Izv. AN SSSR, ser. geofiz., No 1, 1957, pp 21-29.

2. Balavadze, B. K. and Tvaltvadze, G. K., "Structure of the Earth's Crust in Georgia, From Geo-Physical Data," Ibid., No 9, 1958, pp 1075-1084.

3. Bugayaevskiy, G. N., "The Structure of the Earth's Mantle," Byull. sov. po seismologii, No 6, 1957, pp 63-66.

4. Vasil'yev, Yu. I., Kovalev, O. I., and Parkhomenko, I. S., "Study of the Crystalline Basement by the Refracted Waves Method, Under the Conditions of Incomplete Screening, Part I," Izv. AN SSSR, ser. geofiz., No 3, 1958, pp 317-329.

5. Same as above, Part II, Ibid., No 5, 1958, pp 569-581.

6. Vvedenskaya, A. V. and Balakina, L. M., "Some Features of the Field of Shift in Compressional and Transverse Waves Propagating in the Earth's Mantle," Ibid., No 8, 1957, pp 1052-1054.

7. Vvedenskaya, A. V. and Balkina, L. M., "Double Refraction in the Earth's Mantle," Ibid., No 8, 1959, pp 1138-1146.

8. Gal'perin, Ye. I. and Kosminskaya, I. P., "Some Features of Deep Seismic Sounding in the Sea," Ibid., No 7, 1958, pp 833-847.

9. Gal'perin, Ye. I., Goryachev, A. V., and Zverev, S. M., Issledovaniye zemnoy kory v oblasty perekhoda ot aziatskogo kontinenta k Tikhomu okeanu (A Study of the Earth's Crust in the Transition Zone from the Asian Continent to the Pacific), Academy of Sciences USSR Publishing House, Moscow, 1958.

10. Gamburtsev, G. A. and Veytsman, P. S., "Structural Features of the Earth's Crust in Northern Tien-Shan Region, from Data of Deep Seismic Sounding, and Their Correlation with the Data of Geology, Seismology, and Gravimetry," Byull. sov. po seismologii, No 3, 1957, pp 24-37.

11. Dzhibladze, E. A., "The Uneven Energy Radiation from Foci, and the Absorption Coefficient of Spherical Waves," Soobshch. AN Gruz. SSR, Vol 19, No 1, 1957, pp 33-36.

12. Keylis-Borok, V. I. and Monin, A. S., "Magnetoelastic Waves and the Boundary of the Earth's Nucleus," Izv. AN SSSR, ser. geofiz., No 11, 1959, pp 1529-1541.

13. Kosminskaya, I. P., "Application of Deep Seismic Sounding in Various Regions of the USSR," Byull. sov. po seismologii, No 3, 1957, pp 38-40.

14. Kosminskaya, I. P., "Structure of the Earth's Crust from Seismic Data," Byull. Mosk. ob. isp. prirody, Vol 63, otd. Geol, Vol 33, Issue 4, 1958, pp 25-38.

15. Kosminskaya, I. P. and Tulina, Yu. V., "Experiment in Applying the Deep Seismic Sounding Method in the Study of the Earth's Crust in Certain Regions of Western Turkmenia," Izv. AN SSSR, ser. geofiz., No 7, 1957, pp 874-894.

16. Kosminskaya, I. P., Mikhota, G. G., and Tulina, Yu. V., "Structure of the Earth's Crust in the Pamirs-Alai Zone, from Data of Deep Seismic Sounding," Ibid., No. 10, 1958, pp 1162-1180.

17. Kuz'mina, N. V., "Utilization of PS Waves in the Study of the Earth's Crust in the Southwestern Part of the Main Caucasian Range," Ibid., No 7, 1959, pp 1036-1045.

18. Mart'yanov, N. Ye., "Expanding Segments of the Earth's Crust," Dokl. AN SSSR, Vol 116, No 6, 1957, pp 949-951.

19. Neprochnov, Yu. N., "Deep Structure of the Earth's Crust Under the Black Sea Southwest of the Crimea, fr. Seismic Data," Ibid., Vol 125, No 5, 1959, pp 1119-1122.

20. Neprochnov, Yu. P., Goncharov, V. P., and Neprochnova, A. F., "Seismic Data on Structure of the Earth's Crust in the Central Part of the Black Sea," Ibid., Vol 129, No 2, 1959.

21. Neprochnov, Yu. P., and Udintsev, G. B., "Measurements of the Propagation Velocity of Elastic Waves in Unconsolidated Marine Deposits," Izv. AN SSSR, ser. geofiz., No 11, 1959, pp 1699-1701.

22. Papalashvili, V. G., "Some Data of the Thickness of the Earth's Crust in the Caspian Region," Soobshch. AN Gruz. SSR, Vol 21, No 1, 1958, pp 25-28.

23. Polak, L. S., "Damping and Absorption of Reflected Waves in Sedimentary Rocks," Prikladnaya geofizika, Issue 17, 1957, pp 26-32.

24. Riznichenko, N. V., "The Study of the Structure of the Earth's Crust During the Third International Geophysical Year," Izv. AN SSSR, ser. geofiz., No 2, 1957, pp 129-140.

25. Rykunov, L. N., "A Study of the Nature of the Amplitude Decrease for P-Waves in the Shadow Zone on an Earth Model," Ibid., No 10, 1957, pp 1262-1265.

26. Rykunov, L. N., "P-Waves Diffracted on the Earth's Nucleus, and the Rigidity of this Nucleus," Ibid., No 7, 1959, pp 956-964.

27. Savarenskiy, Ye. F. and Ragimov, Sh. S., "Determination of the Average Thickness of the Earth Crust from the Group Velocities of Rayleigh Waves," Ibid., No 9, 1959, pp 1364-1367.

28. Savarenskiy, Ye. F. and Sikharulidze, D. I., "Determination of the Thickness of the Earth's Crust from the Observed Dispersion of Love Waves," Ibid., No 6, 1959, pp 880-883.

29. Savarenskiy, Ye. F., Solov'yeva, O. N., and Shedhkov, B. N., "Observations of the Love Waves at the Moscow Seismic Station, and Structure of the Earth's Crust," Ibid., No 5, 1959, pp 669-675.

30. Tvaltvadze, G. K., "Distribution of Seismic Waves and Structure of the Earth's Crust in the Tkibul' Area," Soobshch. AN Gruz. SSR, Vol 20, No 4, 1958, pp 411-418.

31. Tvaltvadze, G. K., "The Status of Knowledge of Structure and Elastic Properties of the Earth's Crust in Georgia," Tr. inst. geofiziki (AN Gruz. SSR), Issue 17, 1958, pp 195-215.

32. Tvaltvadze, G. K., Kosminskaya, I. P., and Murusidze, G. Ya., "The Results of Study of the Crystalline Basement Surface in the Western Part of the Gori-Mukhrana Depression, by Seismic Methods," Ibid., Vol 16, 1957, pp 135-161.

33. Treskov, A. A., "Results of Determinations of the Thickness of the Earth's Crust From Observations of Distant Earthquakes," Byull. Sov. po seismologii, No 6, 1957, pp 76-80.

34. Shebalin, N. V., "Relationship Between the Index Point and Intensity of Earthquakes, Depending on the Depth of their Foci," Ibid., No 6, 1957, pp 122-126.

35. Shirokova, Ye. I., "Some Data on the Nature of the Velocity Change in Upper Layers of the Earth's Mantle," Izv. AN SSSR, ser. geofiz., No 8, 1959, pp 1127-1132.

3. Conditions and Causes of Earthquakes.

1. Balakina, L. M., "Distribution of Stresses Active in Earthquake Foci in the Northwestern Pacific," Izv. AN SSR, ser. geofiz., No 11, 1959, pp 1599-1604.

2. Bonchkovskiy, V. F., "Some Features of Periodic Changes in the Inclination of the Earth's Surface," Byull. sov. po seismologii, No 6, 1957, pp 135-138.

3. Bonchkovskiy, V. F., "Deformations of the Earth's Crust and the Accompanying Catastrophic Earthquakes," Izv. AN SSSR, ser. geofiz., No 9, 1958, pp 1111-1113.

4. Bonchkovskiy, V. F., "Some Conclusions from Observations of the Inclination of the Earth's Surface," Tr. inst. fiz. zemli (AN SSSR), No 7 (174), 1959.

5. Vvedenskaya, A. V., "Shifts on the Break Surface, Accompanied by Sliding," Izv. AN SSSR, ser. geofiz., No 2, 1958, pp 175-183.

6. Vvedenskaya, A. V., "The Displacement Field in the Continuity Break," Ibid., No 4, 1959, pp 516-526.

7. Gotsadze, O. D., "Dynamic Features of the Caucasian Earthquakes' Foci," Ibid., No 3, 1957, pp 284-300.

8. Gotsadze, O. D., Keylis-Borok, V. I., Kirillova, I. V., Kogan, S. D., Kukhtikova, T. I., Malinovskaya, L. N., and Sorskiy, A. A., "A Study of the Earthquake Mechanism," Tr. geofiz. inst. (AN SSSR), No 40 (166), 1957.

9. Gurevich, G. I., Nersesov, I. A., and Kuznetsov, K. K., "The Law of Earthquake Recurrence as a Consequence of Regularities in Deformation and Shattering," Dokl. AN SSSR, Vol 128, No 6, 1959, pp 1136-1166.

10. Karapetyan, N. K., "Dynamic Parameters of the Foci of Some Caucasian Earthquakes," Izv. AN SSSR, ser. geofiz., No 2, 1958, pp 260-268.

11. Keylis-Borok, V. I., and Malinovskiy, L. N., "Dislocations in the Foci of Weak Earthquakes of Northern Tien-Shan," Byull. sov. po seismologii, No 3, 1957, pp 118-122.

12. Keylis-Borok, V. I. and Kogan, C. D., "A Study of the Earthquake Mechanism," Ibid., No 6, 1957, pp 96-99.

13. Kolgina, A. N., "Experiments in Seismic Modeling of Normal Faults and Contacts Typical of the Ukrainian Crystalline Shield," Tr. inst. geol. nauk (AN SSSR), ser. geofiz., Issue 2, 1958, pp 187-192.

14. Tamrazyan, G. P., "The Tbilisi Earthquakes and Cosmic Conditions of the Earth," Soobshch. AN Gruz. SSR, Vol 19, No 2, 1957, pp 151-158.

15. Tamrazyan, G. P., "Destructive Earthquakes in Trans-Caucasia and the Phases of the Moon," Izv. AN SSSR, ser. geofiz., No 12, 1957, pp 1510-1511.

16. Tamrazyan, G. P., "Intermediate and Deep Foci Earthquakes in Connection with Cosmic Conditions of the Earth," Ibid., No 4, 1959, pp 598-603.

17. Yurkevich, O. I., "Endogenous Factor in Inclinations of the Earth's Surface," Tr. inst. geol. nauk (AN UkrSSR) ser. geofiz., Issue 2, 1958, pp 69-78.

18. Yanovskaya, G. B., "Determination of Dynamic Parameters of an Earthquake Focus From the Record of Surface Waves, Part I," Izv. AN SSSR, ser. geofiz., No 3, 1958, pp 289-301.

4. Seismic Differentiation Into Regions and Seismic Resistance of Structures.

1. Belopukhov, L. K. and Vinogradov, B. A., "Results of Cinematographic Study of Underground Explosions," Uch. sov. po nardno-khozyaystvennomu ispol'zovaniyu vzryva, AN SSSR, sib. otd., No 6, 1959, pp 3-17.

2. Bolotin, V. V., "Static Theory of Seismic Stability of Constructions," Izv. AN SSSR, otd. tekhn. nauk, ser. mekh i mashinostr., No 4, 1959, p 123.

3. Vvedenskaya, N. A., "The Use of Instrument Observations of Weak Earthquakes, in Seismic Differentiation," Izv. AN SSSR, ser. geofiz., No 2, 1958, pp 210-244.

4. Vvedenskaya, N. A., and Kondorskaya, N. V., "Bulletin of Strong Earthquakes in the USSR for 1956," Tr. inst. fiz. zemli (AN SSSR), No 5 (172), Issue 2, 1959, pp 3-19.

5. Gorshkov, G. P., "The Seismic Differentiation Map of China," Nauchn. dokl. vyssh. shkoly, geol. geogr. nauki, No 2, 1958, pp 25-32.

6. Gorshkov, G. P. and Shenkareva, G. A., "The Correlation of Seismic Scales," Tr. inst. fiz. zemli (AN SSSR), No 1 (168), Issue 1, 1958, pp 44-64.

7. Dzhabua, Sh. A., Kats, A. Z., Safar'yan, A. N., Tskhakaya, A. D., and Churayan, A. L., "The Krasnaya Polyana Earthquake 21-27 December 1955 and its Consequences," Byull. sov. po seismologii, No 5, 1958, pp 3-34.

8. Kats, A. Z., "Some Results of Seismic Study in the Krasnaya Polyana Earthquake Zone in Connection with Seismic Differentiation into Regions," Ibid., No 5, 1958, pp 35-54.

9. Kats, A. E., "Some Problems of the Method of Seismic Microdifferentiation," Tr. inst. fiz. zemli (AN SSSR), No 5 (172), Issue 2, 1959, pp 20-59.

10. Kuznetsov, V. P., "The Baku Earthquake, 28 November 1958," Dokl. AN Azerb. SSR, Vol 15, 1959, pp 703-704.

11. Kukebayev, M. M., "Some Notes on the "Regulations for Building in Seismic Areas," Tr. inst. stroitel'stva i stroymater., AN Kazakh SSR, Vol 2, 1959, p 16.

12. Lordkipanidze, R. S. and Kakhatadze, L. N., "Seismic Stability of Rural Construction," Tr. inst. stroit. dela AN SSSR Gruz SSR, Vol 7, 1959, p 142.

13. Martem'yenov, A. I., "On the Cohesion Strength of an Antiseismic Girdle and the Laying of Walls," Izv. AN UzbSSR, No 8, 1956, pp 69-76.

14. Martem'yanov, A. I., "The Ways of Raising the Seismic Stability of Large Blocks of Stonework," Dokl. AN UzbSSR, No 4, 1957, pp 21-24.

15. Medvedev, S. B., "Determination of the Point Value of Earthquakes," Byull. sov. po seismologii, No 6, 1957, pp 105-108.

16. Medvedev, S. B., "The Seismic Differentiation Map of the USSR (1957)," Tr. inst. fiz. zemli (AN SSSR), No 1 (168), Issue 1, 1958, pp 3-28.

17. Medvedev, S. B., "Experimental Study of Seismically Induced Vibrations in Rigid Constructions," Ibid., pp 65-129.

18. Medvedev, S. V., "Relationship Between the Depth of an Earthquake Focus and Isoseisms," Ibid., No 5 (172), Issue 2, 1959, pp 94-99.

19. Medvedev, S. B., "A Study of Seismically Induced Vibrations in Constructions," Ibid., pp 131-192.

20. Nazarov, A. G., " A Method of Testing Models for Seismic Shocks," Dokl. AN ArmSSR, Vol 24, No 1, 1957, pp 9-11.

21. Nazarov, A. G., (A Method of Engineering Analysis of Seismic Forces,) Publishing House of the Academy of Sciences, Armenian SSR, Yerevan', 1959.

22. Napetvaridze, Sh. G., "Seismically Stressed State of Ground," Tr. inst. stroit. dela (AN Gruz. SSR), Vol 7, 1959, p 91.

23. Nechayev, V. A., "Seismic Microdifferentiation of the Stalinabad Area," Izv. otd. yestestv. nauk (AN Tadzh. SSR), Issue 1, 1959, pp 15-33.

24. Pavlov, A. I., "Modular Block in Seismic Construction," Stroit. promyshl., No 2, 1957, pp 19-21.

25. Popov, V. V., "Engineering Geological Criteria for Detailed Seismic Differentiation," Tr. inst. fiz. zemli (AN SSSR), No 5 (172), Issue 2, 1959, pp 81-93.

26. Puchkov, S. V., "Principles of the Comprehensive Seismic Differentiation," Izv. AN SSSR, ser. geofiz., No 1, 1958, pp 107-115.

27. Puchkov, S. V., "Instrument Seismic Microdifferentiation of the 1948 Ashkhabad Earthquake Zone," Tr. inst. fiz. zemli (AN SSSR), No 5 (172), Issue 2, 1959, pp 60-80.

28. Rantsman, Ye. Ya., "Geomorphology andSeismicity of the Surkhob Valley," Dokl. AN SSR, Vol 124, No 1, 1959, pp 171-174.

29. Repina, Z. F., "Destructive Earthquakes of Kirghizia," Tr. AN Kirgh. SSR, otd. seism., 1959, pp 29-50.

30. Rustanovich, D. N., "Preliminary Study of Seismicity in the Krasnaya Polyana Earthquake Zone," Byull. sov. po seism., No 5, 1958, pp 55-62.

31. Safaryan, A. N., "On the Methods of Seismic Differentiation and Microdifferentiation," Tr. inst. stroit. del (AN Gruz. SSR), No 6, 1957.

32. Safaryan, A. N., "On the Methods of Seismic Differentiation," Ibid., No 7, 1959, p 143.

33. Sinitsin, A. P., "Vibrations in Massive Constructions Acted Upon by Vertical Impulses," Stroit. mekh. i raschet sooruzh, No 4, 1959

34. Solonenko, V. P., "Seismic Differentiation of the Mongolian People's Republic," Dokl. AN SSSR, Vol 127, No 2, 1959, pp 419-422.

35. Urazbayev, M. T., "Seismic Stability of Hydroelastic Systems," Stroit. mekh. i raschet sooruzh., No 5, 1959, pp 4-7.

36. Khovanova, R. I., "Range of Action for Some Earthquakes in the Tien-Shan Naryn Zone," Tr. inst. fiz. zemli (AN SSSR), No 5 (172), Issue 2, 1959, pp 114-125.

37. Maryyev, G. O., "Problems of Seismically Stable Construction," Vestnik AN SSSR, No 10, 1957, pp 86-87.

38. Shebalin, N. V., "Determination of the Focus' Depth from Macroseismic Data, Taking Into Account the Effect of the Lower Velocity Layer," Tr. inst. fiz. zemli (AN SSSR), No 5 (172), Issue 2, 1959, pp 100-113.

5. Theoretical and Experimental Study of Seismic Waves.

1. Babich, V. M. and Alekseyev, A. S., "Radial Method of Computing the Intensity of Wave Fronts," Izv. AN SSSR, ser. geofiz., No 1, 1958, pp 17-31.

2. Berzon, I. S., "Experimental Data on Refracted PP Type Waves," Ibid., No 6, 1958, pp 689-712.

3. Berzon, I. S., "Some Spectrum Features of Waves Reflected from Thin Layers," Ibid., No 5, 1959, pp 641-657.

4. Berzon, I. S. and Ratnikova, L. I., "The Nature of Certain Waves Hampering the Identification of Reflected Waves on the Russian Platform," Ibid., No 6, 1957, pp 697-708.

5. Berzon, I. S., Vasil'yev, Yu. I., and Starodubrovskaya, S. P., "Refracted Waves Corresponding to Water Sands, Part I," Ibid., No 1, 1959, pp 32-48.

6. Same as above, Part II, Ibid., No 2, 1959, pp 177-182.

7. Vasil'yev, Yu. I., "Study of Interchangeable Refracted Waves in Seismic Prospecting," Ibid., No 3, 1957, pp 301-318.

8. Vasil'yev, Yu. I., "Comparison of Reflection and Refraction Coefficients for Elastic Waves at the Boundary of Two Solid and Two Liquid Media," Ibid., No 9, 1959, pp 1368-1371.

9. Gvozdev, A. A., "Conditions Prevailing at the Front of Elastic Waves Propagating in a Heterogeneous Medium," Prikl. matem. i mekh., Vol 23, Issue 2, 1959, pp 359-397.

10. Gel'chinskiy, B. Ya. and Ozerov, D. K., "Method of Calculating the Shift in Reflected and Refracted Waves," Tr. vsesoyuzn. nauchn. issled. inst. metodiki i tekhniki razvedki, Collection 1, 1958, pp 277-308.

11. Gol'tsman, F. M., "Application of Linear Systems in Filtering Compound Oscillations," Izv. AN SSSR, ser. geofiz., No 5, 1957, pp 584-594.

12. Gol'tsman, F. M., "Graphoanalytic Method of the Frequency Analysis of Seismic Waves in a Wide Frequency Range," Vestn. Leningr. univ., No 22, 1957, ser. geofiz. i khim., Issue 4, pp 76-88.

13. Gorbatova, V. P., "The Intensity of Refracted and Reflected Compressional Waves at Angles of Incidence Smaller Than the Critical," Prikladnaya geofizika, Issue 18, 1958, pp 30-60.

14. Davydova, N. I., "Relationship of Dynamic Properties of Compressional Refracted (Seismic) Waves, Connected With Thin Layers, and the Rapidity in the Differentiation of Media," Izv. AN SSSR, ser. geofiz., No 10, 1958, pp 1181-1191.

15. Davydova, N. I., "The Relationship of Amplitudes of Compressional Refracted Waves, Connected With Thin Layers, and the Differentiation Rapidity of Media," Ibid., No 5, 1959, pp 658-668.

16. Yepinat'yeva, A. M., "Reflected Waves Originating at Incidence Angles Larger than the Critical," Ibid., No. 6, 1957, pp 709-727.

17. Yepinat'yeva, A. M., "The Compound Multiple Reflected Waves," Ibid., No 8, 1959, pp 1089-1102.

18. Yepinat'yeva, A. M., and Mikhaylova, N. G., "Determining the Types of Multiple Reflected Waves by Their Kinematic and Dynamic Characteristics," Ibid., No 7, 1959, pp 965-980.

19. Evolinskiy, N. V., "Reflected and Refracted Waves Originating at a Plane Interface Between Two Elastic Media, Part I.," Ibid., No 10, 1957, pp 1201-1218.

20. Same as above, Part II, Ibid., No 1, 1958, pp 13-16.

21. Same as above, Part III, Ibid., No 2, 1958, pp 165-174.

22. Evolinskiy, N. V., "Dispersion of the Love Surface Waves in a Two-Layer Medium," Tr. inst. geofiziki (AN Gruz. SSR), Vol 17, 1958, pp 121-137.

23. Ivakin, B. N., "Modeling of the Absorption of Seismic Waves," Izv. AN SSSR, ser. geofiz., No 7, 1958, pp 818-832.

24. Ivakin, B. N., "Micro- and Macro-Structure of Elastic Waves (in One-Dimensional Continuous, Non-Homogeneous Media," Tr. geofiz. inst. (AN SSSR), No 39 (166), 1958.

25. Ivakin, B. N., "Elastic Media with Non-Ideal Inertia and Their Models," Izv. AN SSSR, ser. geofiz., No 2, 1959, pp 210-220.

26. Ivakin, B. N., "Modeling of Some Geophysical Phenomena of Electric Grids," Ibid., No 5, 1959, pp 684-692.

27. Kalinina, R. V., "Relationship Between the Propagation Velocity of Elastic Waves and the Relative Elasticity of Rocks," Prikladnaya geofizika, Issue 19, 1958, pp 216-229.

28. Keylis-Borok, V. I., "Theory of Waves Originating in Shifting," Izv. AN SSSR, ser. geofiz., No 4, 1957, pp 440-448.

29. Keylis-Borok, V. I. and Stesin, I. M., "Dispersion of Rayleigh Waves in a Two-Layer Model of the Earth's Crust," Ibid., No 1, 1959, pp 27-31.

30. Kogan, S. Ya., "The Energy Determination of Spherical Seismic Waves," Ibid., No 9, 1959, pp 1372-1373.

31. Konstantinova, A. G., "The Nature of Elastic Impulses Accompanying the Collapse of Rocks," Ibid., No 4, 1959, pp 604-610.

32. Kurditskaya, A. A., "Some Features of Surface Seismic Waves," Tr. inst. fiz. i geofiziki (AN Turkm. SSR), Vol 6, 1959, pp 108-119.

33. Malinovskaya, L. N., "On the Method of Calculation of the Dynamic Properties of Seismic Waves, Part I, Izv. AN SSSR, ser. geofiz., No 4, 1957, pp 426-439.

34. Malinovskaya, L. N., "Dynamic Properties of Reflected Waves Beyond the Critical Angles," Ibid., No 5, 1957, pp 569-574.

35. Malinovskaya, L. N., "Dynamic Properties of Transverse Waves in Full Inner Reflection," Ibid., No 2, 1958, pp 184-195.

36. Oblogina, T. I., "Diffracted Seismic Waves," Prikladnaya geofizika, Issue 20, 1958, pp 26-45.

37. Pasechnik, I. P., "Seismic and Air Waves Originated in the Eruption of the Bezymyannyy Volcano, 30 March 1956," Izv. AN SSSR, ser. geofiz., No 9, 1958, pp 1121-1126.

38. Parkhomenko, I. S., "Model Study of the Propagation of a Refracted Wave Through a Higher Velocity Layer," Ibid., No 2, 1958, pp 196-209.

39. Parkhomenko, I. S., "Model Study of the Intensity of a Refracted Wave in Its Passage Through a Higher Velocity Layer," Ibid., No 4, 1958, pp 449-457.

40. Parkhomenko, I. S., "The Intensity of a Wave After its Passage Through a Series of Higher Velocity Layers, Part I," Ibid., No 5, 1959, pp 676-683.

41. Same as above, Part II," Ibid., No 6, 1959, pp 827-835.

42. Petrashen', G. I., Materialy kolichestvennogo izucheniya dinamiki seismicheskikh voln, I. II. (Material for the Quantitative Study of Dynamics of Seismic Waves Parts I and II), Leningrad, 1957.

43. Same as above, Part III, Leningrad, 1958.

44. Petrashen', G. I., "Study of the Propagation of Elastic Waves (the Theory and its Introduction into Practice)," Vestn. Leningr. univ., No 22, 1958, Ser. fiz. i khim., Issue 4, pp 119-136.

45. Petrashen', G. I. and Molorkov, L. A., "Some Problems in the Dynamic Theory of Elasticity for Media Carrying Thin Layers," Ibid., pp 137-156.

46. Pod'yapol'skiy, G. S., "Propagation of Elastic Waves in a Stratified Medium," Izv. AN SSSR, ser. geofiz., No 8, 1959, pp 1103-1113.

47. Same as above, Part II, Ibid., No 9, 1959, pp 1265-1277.

48. Pod'yapol'skiy, G. S., "One Formula Connecting the Refracted Wave Coefficient with the Reflecting and Refracting Coefficients," Ibid., No 11, 1959, pp 1560-1569.

49. Radzhabov, M. M., "Some Problems in the Interpretation of Isolated Linear Time-Distance Curves for Refracted Waves," Izv. AN Turkm. SSR, No 4, 1958, pp 3-12.

50. Radzhabov, M. M., "Some Features of Transversal Time-Distance Curves for Refracted Waves," Izv. AN SSSR, ser. geofiz., No 7, 1959, pp 1046-1051.

51. Riznichenko, Yu. V., "Development of Ultrasonic Methods in Seismology," Ibid., No 11, 1957, pp 1341-1346.

52. Riznichenko, Yu. V., "Scattered Reflected-Refracted Seismic Waves," Dokl. AN /SSSR?/, Vol 126, No 4, 1959, pp 759-762.

53. Riznichenko, Yu. V. and Shamina, O. G., "Elastic Waves in a Solid Stratified Medium, From a Study on Two-Dimensional Models," Izv. AN SSSR, ser. geofiz., No 7, 1957, pp 855-873.

54. Riznichenko, Yu. V. and Shamina, O. G., "Elastic Waves in Layers of Finite Thickness (From a Study on Two-Dimensional Models)," Ibid., No 3, 1959, pp 344-359.

55. Savarenskiy, Ye. F., "Determination of Apparent Velocity of Seismic Waves in the Caucasus," Ibid., No 2, 1959, pp 183-188.

56. Savarenskiy, Ye. F., "Elementary Evaluation of the Effect of a Layer on the Oscillations of the Earth's Surface," Ibid., No 10, 1959, pp 1441-1447.

57. Savarenskiy, Ye. F., "Determination of the Group and Phase Velocities from Observations," Ibid., No 11, 1959, pp 1550-1559.

58. Savarenskiy, Ye. F. and Ayvazov, I. V., "Azimuths and Angles of Escape of Seismic Radiations in the Earthquakes of 24-25 April 1957," Tr. inst. geofiz. (AN Gruz. SSR), Vol 17, 1958, pp 177-194.

59. Savarenskiy, Ye. F. and Ayvazov, I.V., "Determination of the Escape Angle for Seismic Radiation," Soobshch. AN Gruz. SSR, Vol 20, No 3, 1958, pp 285-289.

60. Savarenskiy, Ye. F. and Ayvazov, I. V., "Determinations of Azimuths and Angles of Escape for Seismic Radiation," Izv. AN SSSR, ser. geofiz., No 3, 1959, pp 372-381.

61. Savarenskiy, Ye. F. and Ragimov, Sh. S., "Determination of Velocity of Rayleigh Waves and the Direction to Epicenter From Three Proximate Stations," Dokl. AN Azerb. SSR, Vol 14, No 8, 1958, pp 587-594.

62. Silayeva, O. I. andShamina, O. G., "Propagations of Elastic Impulses in Cylindrical Specimens," Izv. AN SSSR, ser. geofiz., No 1, 1958, pp 32-45.

63. Sikhuralidze, D. I., "Study of the Love Waves Dispersion in Proximate Earthquakes," Ibid., No 4, 1959, pp 593-597.

64. Skuridin, G. A., "On the Theory of Dispersion of Elastic Waves on a Curvilinear Boundary," Ibid., No 2, 1957, pp 161-183.

65. Skuridin, G. A., "The Duhamel Principle and Asymptotic Solutions of Dynamic Equations in the Theory of Elasticity, Part I," Ibid., No 1, 1959, pp 3-10.

66. Same as above, Part II, Ibid., No 3, 1959, pp 337-353.

67. Skuridin, G. A. and Gvozdev, A. A., "Extreme Conditions for Abrupt Breaks in Solution of Dynamic Equations in the Elasticity Theory," Ibid., No 2, 1958, pp 145-156.

68. Solov'yev, S. L., "The Change in the Amplitude of Ground Vibration, With Distance, in Surface Waves of the Kurile-Kamchatka Earthquakes," Ibid., No 11, 1958, pp 1323-1334.

69. Urupov, A. K., "Kinematic Features of Multiple Compound Waves," Prikladnaya geofiz., Issue 17, 1957, pp 93-103.

70. Urupov, A. K., "Some Features of Partially-Multiple Reflected Waves," Tr. (Mosk. neft. inst.), Issue 18, 1957, pp 168-183.

71. Fedotov, S. A., "Dynamic Features of Reflected Waves Whose Passage Time is not the Possible Minimum Time," Izv. AN SSSR, ser. geofiz., No 5, 1957, pp 575-583.

72. Filippov, A. F., "Approximate Computation of Reflected and Refracted Waves," Ibid., No 7, 1953, pp 841-854.

73. Khaykovich, I. M. and Khalfin, L. A., "Effective Dynamic Parameters of Non-Homogeneous Media in the Propagation of a Plane Compressional Wave," Ibid., No 4, 1959, pp 505-515.

74. Khaykovich, I. M. and Khalfin, L. A., "Effective Dynamic Parameters of Elastic Waves in the Propagation of a Plane Polarized Transverse Wave," Ibid., No 6, 1959, 815-826.

75. Khalevin, N. I., "The Velocity of Propagation of Elastic Waves in Sedimentary Rocks," Tr. Gorno-Geol. Inst. (Ural'sk. Filial AN SSSR), Issue 30, Geofiz. sborn., No 2, 1957, pp 111-115.

76. Tsepelev, N. V., "Reflection of Elastic Waves in a Non-Homogeneous Medium," Izv. AN SSSR, ser. geofiz., No 1, 1959, pp 11-17.

77. Chekin, B. S., "The Change in the 'Form' of a Wave in Reflection and Refraction," Ibid., No 4, 1957, pp 449-457.

78. Chekin, B. S., "Reflection and Refraction of Seismic Waves on a Poorly Expressed Interface," Ibid., No 1, 1959, pp 18-26.

79. Shamina, O. G., "Absorption of Compressional and Transverse Waves in Specimens of Different Form," Ibid., No 11, 1959, pp 1619-1624.

80. Shamina, O. G. and Silayeva, O. I., "Propagation of Elastic Impulses in Layers of Finite Thickness, With Open Boundaries," Ibid., 1958, No 3, 1958, pp 302-316.

81. Shushakov, S. D., "Multiple Reflected Waves," Prikladnaya geofizika, Issue 20, 1958, pp 3-25.

82. Yanovskaya, T. B., "Dispersion of Rayleigh Waves in a Spherical Layer," Izv. AN SSSR, ser. geofiz., No 7, 1958, pp 801-817.

6. Seismic Equipment.

1. Aksenovich, G. I., Gal'perin, Ye. I., and Zyonchkovskiy, M. A., "Features of the Equipment for Deep Seismic Sounding and the Results of its Testing," Izv. AN SSSR, ser. geofiz., No 2, 1957, pp 184-189.

2. Andreyev, S. S. and Shebalin, N. V., "Use of Short-Period Seismographs for Separating the Interchangeable Waves on Seismograms of Distant Earthquakes," Ibid., No 7, 1957, pp 931-933.

3. Arkhangel'skiy, V. T., "Sensitivity of the Electrodynamic Seismoinclinometer With Galvanometric Recording," Tr. inst. fiz. i geofiz. (AN Turkm. SSR), Vol 4, 1958, pp 3-8.

4. Belotelov, V. L., "Installation for Measuring the Energy of Elastic Waves Propagating in the Earth Crust," Peredovoy nauchn-tekhn. i proizv. opyt, No 11, 1959, -75/2, Theme 38, pp 3-19.

5. Belotelov, V. L., Veshnyakov, N. V., Zhilyayev, I. I., Bereza, G. V., "Seismic Energometer," Izv. AN SSSR, ser. geofiz., No 4, 1959, pp 611-616; and "Equipment for Laboratory Frequency Analysis of Seismic Oscillations," Prikladnaya geofiz., Issue 16, 1957, pp 37-49.

6. Bonchkovskiy, V. F., Karmaleyeva, R. M., "Initial Results of the Performance of an Azimuth Inclinometer Device," Izv. AN SSSR, ser. geofiz., No 8, 1957, pp 1060-1063.

7. Borisevich, Ye. S., "An Optical System for Photorecording of Oscillatory Processes," Ibid., No 3, 1957, pp 331-340.

8. Bryunelli, B. Ye. and Alekseyev, V. V., "Seismic Receiver With a Reverse Connection," Ibid., No 5, 1959, pp 748-751.

9. Bune, V. I., and Kon'kov, A. A., "Experiment in Using Mechanical Seismographs SMP-II in Estimating the Seismic Zone in a Mass Explosion," Tr. (AN Tadzh. SSR), Vol 71, 1957, pp 45-58.

10. Gal'perin, Ye. I., "The Grouping of First Kind, and a Method of Obtaining Multicomponent Azimuth Seismograms," Izv. AN SSSR, ser. geofiz., No 9, 1957, pp 1081-1098.

11. Gol'tsman, F. M., "Selection of Frequency Features in Filters of Seismic Signals," Ibid., No 4, 1959, pp 549-559.

12. Gol'tsman, F. M. and Limbakh, Yu. I., "Device for Frequency Analysis and Synthesis of Non-Stabilized Signals (in Geophysics)," Prikl. geof., Issue 21, 1958, pp 26-36.

13. Yepinat'yeva, A. M. and Ivanova, L. A., "Use of High-Frequency Filtrations in Suppressing the Multiple Reflecting Waves," Izv. AN SSSR, ser. geofiz., No 3, 1959, pp 361-371.

14. Ionychev, N. N., "Determination of theElectrodynamic Constant for a Seismograph Pendulum," Tr. inst. fiz. i geofiz., (AN Turkm. SSR), Vol 3, 1957, pp 91-96.

15. Ionychev, N. N., "Experimental Determination of Elasticity of Suspension System in a Horizontal Pendulum," Ibid., Vol 6, 1959, pp 120-134.

16. Isayev, V. S., "On the Theory ofDirected Action of a Group of Seismographs in an Instance of Impulse Vibrations, Part I," Izv. AN SSSR, ser. geofiz., No 6, 1958, pp 770-782.

17. Same as above, Part II, Ibid., No 10, 1958, pp 1234-1244.

18. Kirnos, D. P., "Development of Domestic Seismic-Instrument Observations," Byull. sov. po seism., No 6, 1957, pp 9-15.

19. Kirnos, D. P., and Kharin, D. A., "Seismograph for the Study of Construction Vibrations, the Seismic Effect of Explosions, and for Recording of Proximate Earthquakes," /Title omitted in original source/ Vol 2, No 2, 1958, pp 147-156.

20. Korostin, G. N., "Automatic Switching On ofSeismograph Recording," Tr. inst. fiz. i geofiz., (AN Turkm. SSR), Vol 5, 1958, pp 75-87.

21. Lazareva, A. P., "The Pulkovo Seismic Station," Byull. sov. po seism., No 6, 1957, pp 5-8.

22. Masarskiy, S. I., "The Work of the Northern Tien-Shan Geophysical Station," Ibid., No 3, 1957, pp 97-105.

23. Memamud, A. Ya., Khudzinskiy, L. L., and Deynega, S. A., "Station for Intermediate Magnetic Recording of Seismic Vibrations," Izv. AN SSSR, ser. geofiz., No 2, 1959, pp 197-209.

24. Moskvina, A. G. and Shebalin, N. V., "Frequency Features of Instruments at the Pulkovo Seismic Station, Ibid., No 11, 1958, pp 1389-1393.

25. Nechayev, V. A., "A Simple Seismometer," Izv. otd. yestestv. nauk (AN Tadzh. SSR), No 20, 1957, pp 37-43.

26. Obukhov, V. A., "An Improvement in the UZS-2 (31) Seismoscope," Izv. AN SSSR, ser. geofiz., No 10, 1959, pp 1513-1516.

27. Obukhov, V. A., "The High-Sensitivity LS-1 Laboratory Seismoscope," Ibid., No 11, 1959, pp 1625-1635.

28. Ostrovskiy, A. Ye., "Seismoinclinometer With Photoelectric Recording," Byull. sov. po seismol., No 6, 1957, pp 130-134.

29. Pak, Z. N., "Theory of Pendulum Seismographs," Uch. zap. Kazakhsk. univ., Vol 30, Matem., mekhanika i fizika, Issue 5, 1957, pp 187-199.

30. Polshkov, M. K. and Slutskovskiy, A. I., "Some Problems in the Theory and Design of the Outbound Cascade in a Seismic Amplifier and Galvanometer," Priklad. geofiz., Issue 18, 1958, pp 61-67.

31. Popov, I. I., "Short-Period Vertical Seismograph With Magnetic Returning Impulse," Izv. AN SSSR, ser. geofiz., No 6, 1958, pp 783-786.

32. Popov, I. I., "Inspection of Seismic Stations in the Caucasus in 1957," Ibid., No 7, 1958, pp 934-936.

33. Prosvirnin, V. M. and Rykunov, L. N., "The Nature of Free Vibrations of Piezogenerators Used in Modeling of Seismic Phenomena," Ibid., No 5, 1959, pp 752-755.

34. Puzyrev, N. N., "Phase Distortions and the Amplitude Characteristics in the Grouping of Seismographs at Large Bases," Prikl. geofiz., Issue 17, 1957, pp 3-5.

35. Radziyevskiy, V. A., "Directed Linear Vibrometric Generator of the Seismic Type," Inform. mater. inst. stroit. mekh. AN Ukr. SSR, No 11, 1959, pp 25-40.

36. Rykov, A. V., "Photoelectric Device For Recording the Energy Flux of Seismic Waves," Izv. AN SSSR, ser. geofiz., No 1, 1959, pp 153-158.

37. Tabulevich, V. N., Struk, Ye. V. and Brand, S. B., "Automatic Reception of Time Signals at the "Makhachkal" Seismic Station," Ibid., No 9, 1958, pp 1137-1138.

38. Tokmakov, V. A., and Kharin, D. A., "Modifications in the SPM-16 Seismic Receiver for Recording of Accelerations in Low Frequency Vibrations," Tr. inst. fiz. zemli (AN SSSR), No 5 (172), Issue 2, 1959, pp 126-130.

39. Kharin, D. A., "New Seismic Equipment for the Study of Ground Vibrations During Explosions," Uch. sovyet po n.-khoz. ispol'zovaniyu vzryva, No 1, 1959, pp 5-6.

40. Kharin, D. A. and Rulev, B. G., "Electrodynamic Seismograph for Recording of Large Displacements," Izv. AN SSSR, ser. geofiz., No 1, 1957, pp 113-115.

41. Khudzinskiy, L. L. and Melamud, A. Ya., "Station for Frequency Analysis of Seismic Vibrations," Ibid., No. 9, 1957, pp 1099-1117.

42. Shakurov, P. F., "High Sensitivity Devices for Determining the Inclination of the Earth's Crust and For Registering the Earthquake Waves," Ibid., No 1, 1959, pp 159-161.

7. Microseisms. Tsunami.

1. Bukhteyev, V. G. and Andreyev, T. A., "Generation of Storm Microseisms," Izv. AN SSSR, ser. geofiz., No 10, 1959, pp 1510-1512.

2. Veshnyakov, N. V., "Some Errors in Determining the Azimuth of Microseisms by the Triple Station Method," Ibid., No 8, 1958, pp 1020-1025.

3. Grigorash, Z. K., "The 1927 Black Sea Tsunami From Tide Gage Records," Tr. Morsk. gidrofiz. inst. (AN SSSR), Vol 17, 1959, pp 59-67.

4. Kostina, A. F., "Relationship of Microseismic Vibrations Observed in the Crimea with Meteorological Conditions Over the Black Sea," Izv. AN SSSR, ser. geofiz., No 8, 1958, pp 1029-1032.

5. Kusova, T. U. and Gurov, V. P., "Using Microseismic Observations For Detecting Cyclones Out in the Ocean," Tr. Leningr. voenn.-vozdushn. inzh. akad., Issue 245, 1958, pp 52-59.

6. Masarskiy, S. I. and Gynkina, N. M., "The Issyk-Kul' Lake Microseisms," Izv. AN SSSR, ser. geofiz., No 6, 1959, pp 884-890.

7. Monakhov, F. I., "Experience in the Study of Microseisms in the USSR," Byull. sov. po seismologii, No 6, 1957, pp 139-145.

8. Monakhov, F. I., "Microseismic Observations," Inform. sb. komiteta po provedeniyu MGG, Gl. upr. gidrometeorolosluzhby, No 5, 1958, pp 26-33.

9. Monakhov, F. I. and Dolbilkina, N. A., "Structure of Microseisms," Izv. AN SSSR, ser. geofiz., No 8, 1958, pp 937-945.

10. Popov, G. I., "The Position of the Tsunami-Induced Earthquakes in the Far East," Ibid., No 8, 1959, pp 1199-1201.

11. Rykunov, L. N. and Prosvirnin, V. M., "The Distortion of Azimuths On a Microseism Source Brought About by the Conditions of Propagation," Ibid., No 8, 1958, pp 1026-1028.

12. Savarenskiy, Ye. F., "The Study of Tsunami," Vest. AN SSSR, No 9, 1958, pp 11-15.

13. Savarenskiy, Ye. F., et al., "The 4-5 November 1952 Tsunami," Byull. sov. po seismol., No 4, 1958, pp 3-62.

14. Savarenskiy, Ye. F., Lysenko, L. N. and Kompanets, M. V., "The Lake Issyk-Kul' Microseisms From Observations at the Rybach'ya Seismic Station," Izv. AN SSSR, ser. geofiz., No 8, 1958, pp 1015-1019.

15. Svyatlovskiy, A. Ye., Tsunami. Razrushitel'nyye volny, voznikayushchiye pri podvodnykh zemletryasennyakh v moryakh i okeanakh (Tsunami. Destructive Waves Surging Up in Submarine Earthquakes in Seas and Oceans), Moscow, Academy of Sciences USSR Publishing House, 1957.

16. Solov'yev, S. L., "Conference of the Tsunami Problem and on Seismicity of the Far East," Izv. AN SSSR, ser. geofiz., No 3, 1958, pp 422-423.

17. Solov'yev, S. L. and Shebalin, N. V., "Tsunami and the Intensity of the Kurile-Kamchatka Earthquakes," Ibid., No 8, 1959, pp 1195-1198.

18. Stolmnina, N. V. and Monakhov, F. I., "Synoptic Conditions of the Origin of Microseisms in the Black Sea," Meteorol. i gidrologiya, No 2, 1958, pp 27-30.

19. Tabulevich, V. N., "The Nature of Microseisms in the Caspian Basin," Izv. AN SSSR, ser. geofiz., No 11, 1959, pp 1694-1698.

20. Tukhtasunov, I. G., "General Aspect of Microseisms Recorded by Seismic Stations of the Tadzhik SSR," Uchen. zap. (Stalinabadskiy zhenskiy ped. inst.), Vol 1, 1957, pp 3-13.

21. Tukhtasunov, I. G., "Resolution of Microseismic Waves Into Rayleigh and Love Waves," Ibid., pp 15-24.

22. Khovanova, R. I., "The T-Phase and Its Possible Connection with Tsunami," Izv. AN SSSR, ser. geofiz., No 10, 1959, pp 1506-1509.

III. SEISMOGEOLOGY

In 1956-1959, the study of the relationship between geologic phenomena and earthquakes, or seismogeology, went on chiefly at the Institute of Physics of the Earth, Academy of Sciences USSR.

As before, this study had a dual purpose. On one hand, it was necessary to refine, in instances of different geologic structures and different degree of seismicity, the relationship between seismic and geologic phenomena which had been suggested by the preceding study, and to investigate more penetratingly the emerging regularities in their capacity as geologic criteria of seismicity. On the other hand, it was necessary to refine on the basis of these regularities, the methods of geologic substantiation for the seismic differentiation maps in the process of making by the Institute, from both seismic and geologic data.

Major field work in this field was done in the Tien-Shan, Northern Pamirs, in some areas of the Caucasus, and partly in the Far East. Other regions were covered by publications -- such as the Baikal-Altai province, and regions of Mongolia, Iran, China, and Turkey, adjacent to the USSR.

As a result of this work, regularities in the relationship between seismic and geologic phenomena in the western part of the USSR have become more definite. Quantitative computations of the velocity of most recent vertical tectonic movements, together with a parallel analysis of these data and of instrument data on earthquakes, were a basis for the first attempt at a geologic substantiation of seismic differentiation maps on a larger scale (such as the 1:500,000 map of Northern Tien-Shan) than had been done before.

At the suggestion of V. V. Belousov, the European Seismological Commission of the Association of Seismology and Physics of the Earth, International Geodetic and Geophysical Union, has adopted a resolution on compiling a seismotectonic map of Europe. To acquaint the participants in this project with the principles of such work as adopted in the USSR, they have been mailed appropriate material as a tentative instruction.

BIBLIOGRAPHY

1. Gzovskiy, M. V., Krestnikov, V. N., Nerkrasov, I. L., and Reisner, G. I., "Correlation of Tectonics and Seismicity of the Garm Region, Tadzhik SSR, Part I," Izv. AN SSSR, ser. geofiz., No 8, 1958.

2. Same as above, Part II, Ibid., No 12, 1958.

3. Gzovskiy, M. V., Krestnikov, V. N., and Reisner, G. I., "Geological Methods of Determining the Average Gradient of Vertical Tectonic Movements (Changes in Slope) of the Earth's Crust and Some Results of Their Application," Ibid., No 8, 1959.

4. Goryachev, A. V., Mezozoysko-kaynozoyskaya struktura, istoriya tektonicheskogo razvitiya i seismichnost' rayona oz. Issyk-Kyl' (Meso-Cenozoic Structure and History of Tectonic Development and Seismicity of the Issyk-Kyl' Area), Academy of Sciences USSR Publishing House, Moscow, 1959.

5. Kazanli, D. N., "Geology of Northern Tien-Shan in Connection with its Seismicity," Byull. soveta po seismologii, No 3, 1957.

6. Krestnikov, V. N., "Seismicity and Geological Structure as Demonstrated in Northern Tien-Shan," Priroda, No 8, 1957.

7. Krestnikov, V. N., "Relationship Between Geologic and Seismic Phenomena in the Tien-Shan," Byull. sov. po seismol., No 3, 1957.

8. Kukhtikova, T. I., "Correlation of Seismic and Geological Data," Tr. (AN Tadzh. SSR), Vol 71, 1957.

9. Levitskaya, A. Ya. and Muratov, M. V., "Relationship Between Seismicity and Tectonic Structure of the Black Sea Trough and Surrounding Provinces," Izv. AN SSSR, ser. geofiz., No 4, 1959.

10. Leonov, N. N., "The 1955 Ulugchat Earthquake," Ibid., No 11, 1959.

11. Petrushevskiy, B. A., "Some Current Problems in Seismogeology," Byull. moskovskogo obshch. ispytateley priprdy, otd. geol., No 5, 1957.

12. Petrushevskiy, B. A., "Geologic Basis of Seismic Differentiation," in the compendium, Stroitel'stvo v seismicheskikh rayonakh (Construction in Seismic Areas), Publishing House of Literature on Construction and Architecture, [place of publication not given], 1957.

13. Petrushevskiy, B. A., Significance of Geologic Phenomena in Seismic Differentiation, (in Chinese), Publishing House of the Academy of Sciences of Chinese People's Republic, 1958.

14. Petrushevskiy, B. A., "Geological Environment of the 1920 Hansu Earthquake," Dokl. AN SSSR, Vol 129, No 2, 1959.

15. Petrushevskiy, B. A., "Contribution to the Study of Seismicity of the Chinese People's Republic," Izv. AN SSSR, ser. geofiz., No 12, 1959.

16. Rantsman, Ye. Ya., "Geomorphology and Seismicity of the Surkhob River Valley," Dokl. AN, Vol 124, No 1, 1959.

17. Rezanov, I. A., "The 1948 Ashkhabad Earthquake and the Geologic Conditions of its Origin," Izv. AN SSSR, ser. geofiz., No 6, 1958.

18. Rezanov, I. A., Tektonika i seimichnost' turkmeno-khorasanskikh gor. (Tectonics and Seismicity of the Turkmeno-Khorasan Mountains), Academy of Sciences USSR Publishing House, 1959.

19. Solonenko, V. P., "The Gobi Altai Earthquake 4 December 1957," Izv. AN SSSR, ser. geol., No 7, 1959.

20. Solonenko, V. P., Treskov, A. A., Florensov, N. A. and Pubhkov, S. V., "The Muisk Earthquake, 27 June 1957," Tr. inst. fiz. zemli (AN SSSR), No 1 (168), Issue 1, 1958.

21. Tokarev, V. A., "Geological Interpretation of Material on Seismicity of the Kola-Scandinavian Region," Dokl. AN., Vol 119, No 4, 1958.

IV. PHYSICS OF THE EARTH'S INTERIOR

The central scientific organization which carries on the study of physics of the deep interior of the Earth is the Institute of Physics of the Earth, Academy of Sciences USSR. Work in the same field has been carried on by a number of other organizations, the most important of which are as follows:

Institute of Geochemistry and Analytic Chemistry, Academy of Sciences (AS) USSR;

Institute of Geochemistry, AS Georgian SSR;

Institute of Seismically Stable Construction and Seismology, AS Tadzhik SSR;

Institute of Physics and Geophysics, AS Turkmen SSR;

Moscow State University;

Leningrad State University;

The Volcanology Laboratory, AS USSR.

The work has been carried on in the following fields: Study of the termal history of the Earth in connection with the theory of its origin; heat exchange under the conditions deep in the interior of the Earth; and a refinement of the fusing temperature-depth curve. In the latter field, the problem of the thermal state of the Earth has been considered for both the abrupt and gradual differentiation of its interior. The conclusion is that the temperature status in the upper parts of the Earth essentially depends on the differentiation scheme accepted. The problem of the Earth's temperature at the early stages of its existence was clarified. The thermodynamics of the Earth's mantle has been computed. The mechanism of fusing was considered, with the appropriate curves derived. Also considered was the effect of different heat-exchange mechanisms on the Earth's temperature.

In the field of study of the physical properties and composition of the several shells of the Earth and of the nature of its main seismic divisions, the conditions equations were considered for some substances by using the results of experiments with high pressures and theoretical methods of solid state physics. Consideration was given to some assumptions of altered types of bond with the change in pressure, and to the changes in chemism with depth. The status of the main physical parameters of the Earth's substance, with depth, was analyzed. The presence of a tide phase lag in a solid Earth has been established from the data on tides in the Earth's body. New data on the rigidity modulus for the Earth's nucleus have been obtained. The problem of the presence and nature of wave conductors in the Earth's mantle was considered.

In the field of study of the origin of the Earth's crust and of the processes of its development, the processes of isolation of the Earth's crust substance from meteorite matter were considered. The structure of the Earth's crust was studied from seismic and gravity data, along with a study of its present movements and with that of isostatic compensation, especially in the region of Antarctic glaciation.

Specific results of this work can be obtained from scientific papers (see Bibliography). The most interesting papers in the list are annotated.

ANNOTATION OF MOST IMPORTANT WORKS

1. Al'tshuller, L. V., Krupnikov, K. K., Ledenev, B. N., Zhuchikhin, V. I., and Brazhnik, M. I., "Dynamic Compressibility and the Condition Equation For Iron at High Pressures," Zhur. eksp. i teoret. fiz., Vol 34, Issue 4, 1958. Iron adiabates obtained by the method of shock waves, in the pressure range from 4×10^5 to 5×10^6 atm. They are used for constructing a compressibility curve for iron, at absolute zero temperature.

2. Al'tshuler, L. V., Krupnikov, K. K., and Brazhnik, M. I., "Dynamic Compressibility of Metals at Pressures from 400 to 4,000,000 Atmospheres," Ibid., Dynamic compressibility of copper, zinc, silver, calcium, tin, gold, lead, and bismuth, in the $4 \times 10^5 - 4 \times 10^6$ atm pressure range was determined by measuring the velocity of propagation for strong shock waves.

3. Andreyev, B. A., "Gravity Anomalies and the Thickness of the Earth's Crust in Continental Provinces," Dokl. AN SSSR, Vol 119, No 2, 1958. A diagram obtained for the relationship of the intensity of Bouguer's anomalies and the thickness of the Earth's crust.

4. Bernshteyn, V. A., "The Magnitude of Stresses Developed Through Convection in the Mantle at its Boundary with the Earth's Crust," Izv. AN SSSR, ser. geofiz., No 9, 1959. A consideration of stationary convection in a spherical layer within the upper mantle, 400-500 km thick, taking place in the presence of a stable temperature gradient at a constant depth.

5. Volarovich, M. P. and Stakhovskaya, Z. I., "A Study of the Young Modulus For Rock Specimens at Confining Pressures up to 5000 kg/cm^2, by the Bending Method," Ibid., No 5, 1958. The equipment and the measuring method described. It is shown that Young's modulus in rocks increases greatly in the 1 - 5,000 kg/cm^2 range; with a further pressure increase, the Young modulus increases less sharply.

6. Volarovich, M. P. and Parkhomenko, E. I., "A Study of Torsional Collapse of Thin Specimens of Rocks at One-Sided Pressure," Ibid., No 2, 1957. Explosive-type breaks have been discovered in thin, disc-

shaped rock specimens under torsion, at one-sided pressure. The minimum value of an "explosion" depends on the plastic properties of rocks.

7. Volarovich, M. P. and Balashov, D. B., "A Study of Velocity of Elastic Waves in Rocks at Pressures up to 5,000 kg/cm^2," Ibid., No 3, 1957. A description of the equipment, method, and results of laboratory measurements of the velocity of elastic waves with ultrasonic frequencies, in specimens of some effusive and sedimentary rocks at confining pressures up to 5,000 kg/cm^2.

8. Dergunov, I. D., "Modern Concept of the Thermal State of the Earth's Crust," Ibid., No 1, 1958. A review of works on the sources and the distribution of heat in the Earth.

9. Zharkov, V. N., "The Fusing Temperature of the Earth's Mantle and of Iron at High Pressures," Ibid., No 3, 1959. The fusing temperature of the mantle determined by the method of critical concentration of thermal deficiencies; also the relationship of fusing temperature for iron and pressure. At a pressure of the order of 1.4 x 10^6 atm, the fusing temperature for iron turned out to be 4,100°K.

10. Zharkov, V. N., "Thermodynamics of the Earth's Mantle," Ibid., No 9, 1959. Thermodynamic properties of the Earth's mantle are considered on the basis of the Einstein model. The results are found to be but slightly dependent on the distribution of temperature and close to those obtained by Affen with the Debye model. The results make it possible to reconstruct the density change in the mantle from the initial value of ρ_{100}, on the assumption that the mantle consists of different but homogeneous layers.

11. Zharkov, V. N., "The Physical Nature of Wave Conductors (Lower Velocity Layers) in Upper Reaches of the Mantle at Depths of 50-200 km," Dokl. AN SSSR, Vol 125, No 4, 1959.

12. Zharkov, V. N., "The Electroconductance and the Temperature of the Earth's Mantle," Izv. AN SSSR, ser. geofiz., No 4, 1958. The temperature change in the Earth's mantle is determined with consideration given to the relationship between compressibility and pressure. A formula is presented for the fusing

temperature as a function of pressure. It is assumed that fusing takes place when the concentration of deficiencies in a crystalline body reaches a definite value. It is further assumed that the abrupt increase in electroconductance in a transition layer (at a depth of about 400-700 km) is connected with the change to semi-conductor alloy conductance.

13. Zharkov, V. N., "The Heat Conductance Coefficient of the Earth's Mantle," Ibid., No 11, 1958. It is shown that the heat exchange factor consists of a lattice portion determined by the heat transfer by infra-red electromagnetic waves. A formula is obtained for the lattice portion of the heat exchange factor, which presents it as a function of temperature and pressure. A gasokinetic derivation of the radiant portion of the heat exchange factor is given. The analysis has shown the truth of the qualitative picture of the Earth's cooling, as obtained by Slichter.

14. Kalinin, V. A., "The Condition Equation for Solid Argon," Zhur. eksp. i teoret. fiz., Vol 34, Issue 1, 1958. An analytic expression obtained for the solid-argon condition equation, holding true in a wide temperature and pressure range.

15. Kapustinskiy, A. F., O Vnutrennem Stroyenii Zemnogo Shara, (The Internal Structure of the Earth), Byull. Moskovskogo obshch. ispytateley prirody, otd. geol., Vol 33, No 4, 1958. The author presents a new model of the earth, homogeneously changing its chemical composition with depth but with a gradual degeneration of chemical properties of atoms.

16. Kapustinskiy, A. F., "To a New Conception of the Internal Constitution of the Earth," Experimenta, Vol 14, No 12, 1958. The author rejects the hypotheses of Goldschmidt and Lodochnikov and presents the hypothesis of a three-layer Earth: The zone of normal chemism; the zone of degenerated chemism; and the zone of zero chemism.

17. Kosminskaya, I. P., Mikhota, G. G., and Tulina, Yu. V., "Structure of the Earth's Crust in the Pamirs-Altai Zone, From Data of Deep Seismic Sounding," Izv. AN SSSR, ser. geofiz., No 12, 1958. The results of study of the earth's crust. It is shown that negative anomalies observed in this region, being a maximum for the USSR, can be explained by the relief of deep-seated boundaries.

18. Kosminskiy, I. P., "Structure of the Earth's Crust from Seismic Data," Byull. Moskovskogo obshch. ispytateley priroda, otd. geol, Vol 33, No 3, 1958. A review of seismic research.

19. Latynina, L. A., "Heat Convection in the Earth's Mantle," Izv. AN SSSR, ser. geofiz., No 9, 1958. A study of non-stationary heat convection in a layer of pseudo-viscous liquid with consideration given to heat transfer by mobile masses.

20. Lyubimova, Ye. A., "Thermal History and Temperature of the Earth," Byull. Moskovskogo obshch. ispytateley prirody, No 4, Vol 33, 1958. The substantial part of radiant heat exchange is established for the process of heat transfer in the Earth's mantle. It is demonstrated that the heat conductance of the mantle passes through a minimum at the depth of a few hundred kilometers, then increases rapidly. The possibility is considered for the formation of a molten belt in the upper part of the Earth's mantle, in the past.

21. Lyubimova, Ye. A., "The Temperature Gradient in the Upper Layers of the Earth and a Possible Explanation of the Low Velocity Layer," Izv. AN SSSR, ser. geofiz., No 12, 1959. The passage of heat conductance through a minimum at a depth of about 100 km leads to a local rise in the temperature gradient, fully adequate to explain the observed lowering in the velocity of seismic waves.

22. Lyustikh, Ye. N., "Convection in the Earth's Mantle According to Pickeris' calculations," Ibid., No 5, 1957. A critical discussion of the Pickeris convection models to explain geotectonic processes. The author concludes that the world gravimetric survey also does not confirm the convection hypothesis.

23. Magnitskiy, V. A., "The Origin and Development of Continents and Oceans," in the compendium, Voprosy Kosmogonii, (Problems of Cosmogony), Vol 6, Moscow, Academy of Sciences USSR, 1958. An analysis of the hypothesis of the oceans' growth through submergence of continents, and of the growth of continents through the change of oceanic type crust to the continental.

24. Magnitskiy, V. A., "The Wave Conductors in the Earth's Crust and in the Subcrustal Layer," Byull. Moskovskogo obshch. ispytateley prirody, otd. geol., Vol 33, No 4, 1958. An analysis of physical causes for the origin of wave conductors in the Earth's crust and the subcrustal layer, with consideration given to the temperature effect and the effect of phase changes and of variable composition.

25. Magnitskiy, V. A. and Kalinin, V. A., "Properties of the Earth's Mantle and the Physical Nature of the Transition Layer," Izv. AN SSSR, ser. geofiz., No 1, 1959. The possibility is considered of explaining the properties of a layer transitional from a predominantly ion bond in the upper part of the mantle to a predominantly covalent bond in deeper parts, without involving any hypothesis of chemical properties of the mantle substance.

26. Petrova, G. N., "Magnetic Stability of Rocks," Ibid., No 6, 1957. Experimental study of stability of some rocks with relation to direct and alternating magnetic fields.

27. Risnichenko, Yu. V., "A Study of the Structure of the Earth's Crust in the USSR by the Deep Seismic Sounding Method," /Source not given/, Vol 2, No 2, 1958. A review of deep seismic sounding carried out in 1949-1956 by Institute of the Physics of Earth in collaboration with other organizations.

28. Rykunov, L. N., "Diffraction of P-waves on the Earth's Nucleus, and the Latter's Rigidity," Izv. AN SSSR, ser. geofiz., No 7, 1959. A model study of the possibility of evaluating the shearing modulus for the Earth's nucleus, from the nature of decrease in P-wave amplitudes in the shadow zone.

29. Sologub, B. B., Galushko, P. Ya, Vopilkin, A. A., and Patiokhi, A. M., "The Propagation Velocity of Compressional Elastic Waves in Rocks, and its Dependance on Static Load and Humidity," Tr. inst. geol. nauk AN SSSR, ser. geofiz., Issue 2, 1958. The velocity of ultrasonic waves measured on a cube-shaped rock specimen, directionally compressed up to 600 atm.

30. Trubitsyn, V. P., "The Condition Equation for a MgO Crystal," Zhur. eksp. i teoret. fiz., Vol 34, Issue 1, 1958. Statistical method used in setting up the condition equation for a MgO crystal, holding true for a wide pressure range from 0 to 10^7 atm.

31. Fesenkov, V. G., "Early Thermal History of the Earth," Astronomnyy zhurnal, Vol 34, No 1, 1957. History of the Earth on the assumption of its original molten state.

32. Shirokova, Ye. I., "Some Data on the Velocity Changes in Upper Layers of the Earth's Mantle," Izv. AN SSSR, No 8, 1959. The nature of velocity changes for compressional waves in upper layers of the Earth's mantle is determined on the basis of a study of the Hindukush earthquakes. It is shown that a low velocity layer, occurring at a depth of 60-100 km, persists as far as 200 m and has fairly well defined boundaries.

BIBLIOGRAPHY

1. Andreyev, B. A., "Relationship Between Structural Relief and Gravity Anomalies in the Instance of Several Dividing Density Boundaries," Dokl. AN SSSR, Vol 124, No 2, 1958.

2. Andreyev, S. S., "Study of the Deep Structure of the Earth's Crust by Means of PS Waves Recorded During Earthquakes," Izv. AN SSSR, ser. geofiz., No 1, 1957.

3. Balavadze, B. K., Gravitatsionnoye zemnoy kory v Gruzii (Gravitational Field and Structure of the Earth's Crust in Georgia), Publishing House of Academy of Sciences Georgian SSR, Tbilisi, 1957.

4. Baranov, V. I. "Lead Isochrons for Southern Rocks and the Age of the Earth's Crust," Geokhimiya, Issue 7, 1957.

5. Baranov, V. I. and Serdyukova, A. S., "Radiogenous Heat," Priroda, No 3, 1959.

6. Bayuk, Ye. I., "Method of Determination of Elastic Parameters in Rock Specimens," Izv. AN SSSR, ser. geofiz., No 6, 1959.

7. Belousov, V. V., "Geological Evaluation of Some Modern Geophysical Concepts," Byull. Moskovskogo obshch. ispytateley priprody, otd. geol., Vol 33, No 4, 1958.

8. Vvedenskaya, A. V. and Balakina, L. M., "Double Refraction in the Earth's Mantle," Izv. AN SSSR, ser. geofiz., No 8, 1959.

9. Vereshchagin, L. F., "The Physics of Superhigh Pressures," Priroda, No 6, 1957.

10. Vinogradov, A. P., "The Isotope Composition of Terrestrial Rocks and Meteorites," Atomnaya energiya, Vol 4, No 5, 1958.

11. Vinogradov, A. P., "Meteorites and the Earth's Crust," Izv. AN SSSR, ser. geofiz., No 10, 1959.

12. Volarovich, M. P., Balashov, D. B., and Pavlogradskiy, V. A., "Study of Compressibility of Rocks at Pressures Up to 5,000 kg/cm^2," Ibid., No 5, 1959.

13. Volarovich, M. P., Parkhomenko, E. I., and Sobolev, G. A., "A Study of the Piezoelectric Effect of Quartz-Carrying Rocks, Under Field Conditions," Dokl. AN SSSR, Vol 128, No 3, 1959.

14. Volarovich, M. P. and Parkhomenko, E. I., "Modeling of the Connection of Disturbance in the Electric Field in Rocks at the Piezoelectric Effect, and Seismic Phenomena," Izv. AN SSSR, ser. geofiz., No 1, 1959.

15. Volarovich, M. P., Balashov, D. B., and Stakhovskaya, E. I., "A Study of Elastic Properties of Rocks at High Pressures," Tr. Pyatogo soveshch. po experiment. i tekhnich. mineralogii i petrografii, 1958.

16. Volarovich, M. P. and Gurvich, A. S., "A Study of the Dynamic Elasticity Modulus of Rocks as a Function of Temperature," Izv. AN SSSR, ser. geofiz., No 4, 1957.

17. Gromov, C. V., "Simultaneous Determination of the Mass and Figure of the Earth from Astronomogeodetic Data," Vestn. Leningr. Gos. Univ., No 1, Issue 1, 1959.

18. Dolginov, S. Sh. and Pushkov, N. V., "Results of Measurement of Magnetic Field of the Earth by a Cosmic Rocket," Dokl. AN SSSR, Vol 129, No 1, 1959.

19. Kalshnikov, A. G., "Observation of Rapid Pulsations of Geomagnetic Field," Priroda, No 4, 1959.

20. Kalinin, Yu. D., "Soviet Study of Geomagnetism," Ibid., No 8, 1958.

21. Kirillov, I. V., "Hypothesis of the Development of the Earth, its Continents and Oceanic Troughs (Report)," Byull. Mosk. obshch. ispytateley prirody, otd. geol., Vol 32, No 12, 1958.

22. Klushin, I. G., "Study of the Sources of Deep-Seated Gravity and Magnetic Anomalies," Izv. AN SSSR, ser. geofiz., No 9, 1959.

23. Kozinskiy, V. A., "Approximation of Magnetic Anomalies and Reductions by Interpolation Polynomials," Ibid., No 10, 1959.

24. Kozinskiy, V. A., "Interpolation Polynomials as Applied to the Study of the Earth's Physics," Ibid., No 2, 1959.

25. Koryakin, Ye. D., "Deep Structure of the Earth's Crust in the Atlantic Province," Ibid., No 12, 1958.

26. Kraskovskiy, S. A., "Temperature Measurements in the Earth's Crust," Tr. inst. geofiz., AN Gruz. SSSR, Vol 17, 1958.

27. Krat, V. A., "Origin of the Terrestrial Group Planets," in the compendium, Voprosy Kosmogonii, No 5, Academy of Sciences USSR, Moscow, 1957.

28. Kulikov, K. A., "Astronomy and the Study of the Deep Layer of the Earth," Priroda, No 6, 1958.

29. Latynina, L. A., "On the Existence of Convection Currents in the Earth's Mantle," Izv. AN SSSR, ser. geofiz., No 3, 1958.

30. Levin, B. Yu., "Formation of the Earth Out of Cold Substance and the Problem of Formation of Simplest Organic Compounds," in the collection Vozniknoveniye zhizni na zemle (Origin of Life on Earth), Academy of Sciences USSR, Leningrad, 1957.

31. Levin, B. Yu., "Origin and Composition of the Earth," Izv. AN SSSR, ser. geofiz., No 11, 1957(paper read in Toronto, Sept. 1957).

32. Lyubimova, Ye. A., "Thermal History of the Earth and Its Geophysical Consequences," in the book Problemy Geotermii i Prakticheskogo Ispol'zovaniya Tepla Zemli, (Problems of Geothermals and the Practical Utilization of the Heat of the Earth), Moscow, 1959.

33. Lyubimova, Ye. A., "On the Part of Radiant Heat Exchange in the Thermal State of the Earth," Izv. AN SSSR, ser. geofiz., No 5, 1957.

34. Lyubimova, N. A. "Thermal History of the Earth With Consideration of the Variable Thermal Conductivity of Its Mantle," Geoph. Journ. of the Royal Astron. Soc., Vol 1, 2, 1958.

35. Lyustikh, Ye. N., Kropotkin, P. N., et al, Anomalii sily tyazhesti na materikakh i okeanakh i ikh znacheniye dlya tektonofiziki (Gravity Anomalies on Dontinents and in Oceans and Their Significance in Tectonomphysics), Moscow, 1958.

36. Lyustikh, Ye. A., "The Part of Volcanoes and Thermal Springs in the Removal of Heat From the Earth's Interior," in the book Problemy geotermii i Prakticheskogo Ispol'zovaniya Tepla, op. cit.

37. Lyustikh, Ye. N., Izostasiya i izostaticheskiye gipotezy (Isostasy and Isostatic Hypotheses), Academy of Sciences USSR, Moscow, 1957.

38. Lyustikh, Ye. N., Kritika geotektonicheskoy kontraktsionnoy gipotezy (Criticism of the Contraction Geotectonic Hypothesis), Academy of Sciences USSR, Moscow, 1958.

39. Meshcheryakov, Yu. A., "Recent Movements of the Earth's Crust," Priroda, No 9, 1958.

40. Molodenskiy, M. S., "Modern Problems in the Study of the Figure of the Earth," Geodeziya i kartografiya, No 7, 1958.

41. Parkhomenko, E. I., "Measurement of Piezoelectric Moduli for Rocks, by Static Method," Izv. AN SSSR, ser. geofiz., No 4, 1957.

42. Pertsev, B. P., Pariyskiy, N. N., and Kramer, M. V., "Comparison of Different Methods of Harmonic Analysis of the Earth's Tidal Deformations," Ibid., No 2, 1959.

43. Pertsev, B. P., "Harmonic Analysis of Elastic Tides," Ibid., No 8, 1958.

44. Petrova, G. N. and Koroleva, V. A., "Determination of Magnetic Stability of Rocks Under Laboratory Conditions," Ibid., No 5, 1959.

45. Petrova, G. N. and Pospelova, G. A., "Some Features of Thermomagnetization," Ibid., No 6, 1957.

46. Petrova, G. N., "On Magnetic Stability of Rocks," Ann. Geophys., Vol 15, I, 1959.

47. Popov, V. N., "Growth Nuclei for Material of Sial Crust (from Central Asian Data," Byull. Mósk. obshch. ispytateley prirody, otd. geol., Vol 33, No 3, 1958.

48. Pochtaryev, V. I., "Possible Source of the World's Magnetic Anomalies," Izv. AN SSSR, ser. geofiz., No 6, 1957.

49. Riznichenko, Yu. V., "Study of the Structure of the Earth's Crust During the Third International Geophysical Year," Ibid., No 2, 1957.

50. Savarenskiy, Ye. F. and Sikharulidze, D. I., "Determination of the Thickness of the Earth's Crust from the Observed Dispersion of Love's Waves," Ibid., No 6, 1959.

51. Savarenskiy, Ye. F. and Ragimov, Sh. S., "Determination of the Average Thickness of the Earth's Crust from Group Velocities of Rayleigh Waves," Ibid., No 9, 1959.

52. Safronov, V. S., "The Original Temperature of the Earth," Ibid., No 1, 1959.

53. "Physics of the Interior of the Earth," in the collection Soobshcheniye o nauchnykh rabotakh po seysmologii i fizike nedr zemli (Report on Scientific Work in Seismology and Physics of the Earth's Interior), Academy of Sciences USSR, Moscow, 1957. Bibliography, 80 items.

54. "Magnetic Properties of Rocks." in the collection Soobshcheniye o nauchnykh rabotakh po geomagnetizmu i aeronomii (Report on Scientific Work in Geomagnetism and Aeronomics), Acadamy of Sciences USSR, Moscow, 1957.

55. Tetevosyan, L. K., "Some Features of Deep Structure of the Earth's Crust in Azerbaidzhan, From Gravimetric Data," Izv. AN SSSR, ser. geofiz., No 5, 1958.

56. Tikhomirov, V. V., "Development of the Earth's Crust and the Nature of Granite," Ibid., No 8, 1958.

57. Treskov, A. A., "Results of the Determination of Thickness of the Earth's Crust From Observations of Distant Earthquakes," Byull. sov. po seismol., AN SSSR, No 6, 1957.

58. Fedorov, Ye. P., Nutatsij i vynuzhdennoye dvizheniye polyusov zemli po dannym shirotnykh nablyudeniy (Nutations and Migration of Terrestrial Poles, From Latitude Observations), Academy of Sciences USSR Kiev, 1958.

59. Fedorov, Ye. P., "Nutations, From Latitude Observations," Astron. Zhurn., Vol 36, Issue 5, 1959.

60. Fedorov, Ye. P., "The Earth's Nucleus-Mantle Interaction Forces Originating in Nutation," Dokl. AN SSSR, Vol 115, No 6, 1957.

61. Khain, V. S., "Some Problems of Origin and Classification of Folds in the Earth's Crust," Byull. Mosk. obshch. ispytateley prirody, otd. geol., Vol 32, No 5, 1957.

62. Enenshteyn, B. S, "Resistivity of Rocks for AC Current," Izv. AN SSSR, ser. geofiz., No 5, 1958.

63. Ushakov, S. A. and Lazarev, G. Ye., "Some Conclusions From Seismic and Gravity Data Along the Little America-Byrd Line," Byull. sov. antarkt. eksped., No 9, 1959.

64. Ushakov, S. A. and Lazarev, G. Ye., "Thickness of the Earth's Crust Along the Davis Sea-Pionerskaya Station Meridional Profile," Ibid., No 10.

V. TECTONOPHYSICS

The main results of tectonophysical studies in the USSR, up to and including 1956, have been set forth both in an abbreviated (1) and an expanded form (36). In 1957-1959, regular tectonophysical study was conducted chiefly at the following Scientific Organizations:

At the Institute of Physics of the Earth, AS USSR, work proceeded in connection with problems of forecasting earthquakes, the origin of folding, and the internal structure and development of the Earth. Extensive field work was carried on in the Caucasus and Central Asia, as well as work with models and the development of models, and the study of the physico-mechanical properties of rocks.

At the beginning of 1957, the Institute called the First All-Union Tectonophysical Conference on Tectonics, Physics, Geophysics, Minerals, and Engineering Geology. A report on this Conference has been published (92), along with its full resolution (93) formulating the basic problems of further study.

The mechanism of folding has been studied, both in the field and in the laboratory, at the State University imeni Lomonosov. The Institute of Geology of Mineral Deposits, AS USSR, continued its study of the physico-mechanical properties of rocks and the formation of hydrothermal ore deposits.

To a smaller extent, tectonophysical work was carried on by a number of other organizations, such as the All-Union Scientific-Research Institute of Petroleum Geology, the Geological Institute of the AS Ukrainian SSR, Geological Institute of the Siberian Section of the AS USSR, and the Moscow Geologic Exploration Institute.

The following principal tectonophysical concepts were either advanced or supported by field data from many regions of the USSR in 1957-1959:

1. The idea of a limited distribution of morphologically full folding in geo-synclinal provinces and of the preponderance in them of morphologically intermediate folding types (8, 36, 38, 85).

2. The idea of long duration in the making of intermediate type folds in geo-synclinal provinces, with a considerable disparity in the rate of their development (36).

3. The concept that the leading part in the folding mechanism within geo-synclinal provinces belongs to displacement of large and small plastic basement blocks, resulting in the general step-ladder structure of folded zones and determining the very broad development of the box type folding (8-11, 36, 38, 45, 46, 81, 94, 105).

4. The great importance of the recurrent reversal in the relative displacement of adjacent blocks in the development of the Earth's crust structure, with the possibility of intensive folding and of initiating long and narrow grabens and horsts along these blocks, as a result of such movement (11, 36, 38, 45, 46, 81).

5. The effect of the mechanical properties of stratified sequences on their deformation under a longitudinal compressive stress, along with the nature of physical conditions of the origin of such longitudinal flexures (35, 36, 106, 107).

6. The mechanism and the conditions of development of gravitational buoyance folds and diapirs (11, 59-61, 66).

7. The long duration of the process of forming major faults by consolidation of smaller ones, which may determine the relationship between the mineralization of major and minor faults and the ratio of the number of strong and weak earthquakes (15, 25, 32, 36, 73, 76, 77).

8. Concepts substantiating the quantitative relationship between tectonic movements (first of all the velocity gradient for tectonic movements) and the energy and the recurrence of earthquakes in time; also maps of the earthquake foci (4, 14, 32, 38, 39, 41, 85, 104, 116).

9. Concepts of types of tectonic deformations, stressed states, and breaks, favorable for the formation of ore and oil deposits; emphasis was put on the anisotropy of deformed bodies of rocks; on the long duration of the stress development; on the alternation in time of the compression and tension phases. [References omitted in source.]

10. Elasticity moduli as a function of mineral composition, structure, porosity and geologic history of rocks, their stress and temperature, also of the dynamic and static load (5, 17, 19-22, 49-52, 64, 78, 79, 80, 86, 87, 91, 103).

11. Plasticity of various minerals and rocks (carbonates, barite, quartz) and the considerable permeability of plastic deformation zones in ore-bearing rocks, to vapors and solutions of metals (31, 42, 43, 53, 62, 63, 88, 89, 99).

12. The strength of rocks as a function of their mineral composition, structure, porosity, and geological history (16, 18, 48, 52, 79, 100).

13. Principles, methods, equipment, and material used in modeling tectonic phenomena, and the evaluation of the results of such modeling. A number of plastic substances was evolved and tested in determining stresses in plastically deforming models, by an optical method. Equipment has been devised for determining the physical properties of models (11, 35, 40, 54.55, 82, 117-119).

Some of the 1957-1959 tectonophysical results are not shown in the following list, because they were published in 1960.

BIBLIOGRAPHY

1. AN SSSR Committe on Geodesy and Geophysics: Chapter IV. Tectonophysics (report on the 1956 work in the USSR), Academy of Sciences USSR Publishing House, Moscow, 1957.

2. Apressov, S. M., "Depth of Folded Systems and Deep-Seated Faults," Byull. Mosk. obshch. ispytateley prirody, otd. geol., Vol 32, Issue 4, 1957.

3. Afonichev, N. A., "Significance of the Dzhungari Normal Fault in the Formation of the Dzhungari Alatau Alpine Structures," Sov. geol., No 6, 1959.

4. Balakina, L. M., "Distribution of Stresses Active in the Northwestern Pacific Earthquake Foci," Izv. AN SSSR, ser. geofiz., No 11, 1959.

5. Belikov, B. P., Uprugiye svoystva gornykh porod mater. k II vses. petrograf. soveshch. (Elastic Properties of Rocks. Material on the II All-Union Petrography Conference), Tashkent, 1958.

6. Belitskiy, A. A., "On the Methods of Forecasting the Disturbances in the Kuzbas Mine Fields," Izv. Tomsk. politekhn. inst., No 99, Tomsk University Publishing House, Tomsk, 1959.

7. Belitskiy, A. A., "On the Classification of Faults," Ibid.

8. Belousov, V. V., "The Origin and Types of Folding," Sov. geol., No 1, 1958.

9. Belousov, V. V., "Geological Evaluation of Some Modern Geophysical Concepts," Byull. Mosk. obshch. ispytateley prirody, otd. geol., Vol 33, Issue 4, 1958.

10. Belousov, V. V., "Tectonophysics - A New and Promising Branch of Geology," Vestn. AN SSSR, No 9, 1958.

11. Belousov, V. V., "Results and Potential of Tectonophysical Study," Izv. AN SSSR, ser. geofiz., No 11, 1958.

12. Bubnov, S. N., "Tectonic Phases and the Nature of Processes of the Earth's Deformations Related to its Internal Dynamics," Byull. Mosk. obshch. ispytateley prirody, otd. geol., Vol 33, Issue 1, 1958.

13. Budanov, N. D., "The Part of the Most Recent Tectonics and Related Fractures in the Hydrogeology of the Urals," Sov. geol., Collection 58, 1957.

14. Vvedenskaya, A. V., "Displacement in the Fracture Plane, Accompanied By Sliding," Izv. AN SSSR, ser. geofiz., No 2, 1958.

15. Vinogradov, S. D., "Distribution of the Number of Joints (Fractures), According to Energy, in the Collapse of Rocks," Ibid., No 12, 1959.

16. Vinogradov, S. D. and Kuznetsova, K. I., "Methods and Equipment for Studying the Collapse of Materials Under the Conditions of a Simple Shift," Ibid., No 5, 1959.

17. Volarovich, M. P. and Stakhovskaya, Z. I., "A Study of the Young Modulus For Rock Specimens at Confining Pressures up to 5000 kg/cm^2, by the Bending Method," Ibid., No 5, 1958. The equipment and the measuring method described. It is shown that Young's modulus in rocks increases greatly in the 1 - 5,000 kg/cm^2 range; with a further pressure increase, the Young modulus increases less sharply.

18. Volarovich, M. P. and Parkhomenko, E. I., "A Study of Torsional Collapse of Thin Specimens of Rocks at One-Sided Pressure," Ibid., No 2, 1957. Explosive-type breaks have been discovered in thin, dise-shaped rock specimens under torsion, at one-sided pressure. The minimum value of an "explosion" pressure depends on the plastic properties of rocks.

19. Volarovich, M. P. and Balashov, D. B., "A Study of Velocity of Elastic Waves in Rocks at Pressures up to 5,000 kg/cm^2," Ibid., No 3, 1957. A description of the equipment, method, and results of laboratory measurements of the velocity of elastic waves with ultrasonic frequencies, in specimens of some effusive and sedimentary rocks at confining pressures up to 5,000 kg/cm^2.

20. Volarovich, M. P. and Gurvich, A. S., "A Study of the Dynamic Elasticity Modulus of Rocks as a Function of Temperature," Izv. AN SSSR, ser. geofiz., No 4, 1957.

21. Volarovich, M. P., and Parkhomenko, E. I., "Modeling of the Connecting of Disturbance in the Electric Field in Rocks at the Piezoelectric Effect, and Seismic Phenomena," Izv. AN SSSR, ser. geofiz., No 1, 1959.

22. Volarovich, M. P., Balshov, D. B., and Pavlogradskiy, V. A., "Study of Compressibility of Rocks at Pressures Up to 5,000 kg/cm^2," Ibid., No 5, 1959.

23. Volarovich, M. P., Parkhomenko, E. I., and Sobolev, G. A., "A Study of the Piezoelectric Effect of Quartz-Carrying Rocks, Under Field Conditions," Dokl. AN SSSR, Vol 128, No 3, 1959.

24. Vol'fson, F. I., "Structural Exploration Criteria in Hydrothermal Ore Fields," Iz. min. vyssh. obraz. ser. tsvern. metal., No 3, 1959.

25. Vol'fson, Kreiter, V. M., and Lukin, L. I., "Principal Results of the Study of Structures in Mine Fields and Ore Deposits of the USSR," Izv. AN SSSR, ser. geolog., No 11, 1957.

26. Vol'fson, F. I. and Kukin, L. I., Strukrurnyye i Litologicheskiye Kriterii Poiskov Slepykh Rudnykh Tel Gidrotermal'nykh Mestorozhdeniy. Mater. k. Vses. Soveshch. po Razrab. Nauchn. Osnov Poiskov Slepykh Rudnykh Tel. Tezisy Dokl. (Structural and Lithologic Criteria in the Search for Hidden Ore Bodies of Hydrothermal Deposits. Material for the All-Union Conference on Working Out the Scientific Fundamentals of Searching for Hidden Ore Deposits. Thesis Report), State Publishing House of Technical Geologic Literature, 1958.

27. Vol'fson, F. I. and Kuznetsov, K. F., "Regularities in the Distribution of Lead-Zinc Mineralization in the Argun' Polymetal Belt of Eastern Trans-Baikalia," Tr. Komissii po zakonomern. razmeshch. polezn. iskop., Academy of Sciences USSR Publishing House, 1958.

28. Vol'fson, F. I. and Lukin, L. I., "Study of Structures in Endogenetic Ore Fields and Deposits," Vestn. AN SSSR, No 4, 1958.

29. Vol'fson, F. I. and Druzhinin, A. I., "Structural Types of Lead-Zinc and Tungsten Deposits in Eastern Trans-Baikalia," Tr. vost. sib. fil. AN SSSR, 1959.

30. Vol'fson, F. I., Radkevich, Ye. A., Kuznetsov, K. F., "Structural Factors of the Mineralization Control and the Prospects of Development of Lead-Zinc Industry in Eastern Trans-Baikalia," Tr. Chitinsk. geol. upr., 1959.

31. Gaddin, N. Ye., "Structural Features of the Belousov Ore Deposit in the Altai," Izv. AN SSSR, ser. geol., No 4, 1957.

32. Gzovskiy, M. V., "Tectonophysical Substantiation of Geological Criteria of Seismicity Parts I & II," Izv. AN SSSR, ser. geofiz., No 2-3, 1957.

33. Gzovskiy, M. V., "Development of Tectonophysics," Vestn. AN SSSR, No 4, 1957.

34. Gzovskiy, M. V., "Problems in Tectonophysics," Priroda, No 6, 1957.

35. Gzovskiy, M. V., "The Modeling Method in Tectonophysics," Sov. geol., No 4, 1958.

36. Gzovskiy, M. V., Osnovnyye voprosy tektonofiziki i tektonika baydzhansayskogo anticlinoriya (Main Problems in Tectonophysics and Tectonics of the Baidzhansay Anticlinorium), Academy of Sciences USSR Publishing House, Moscow, 1959.

37. Gzovskiy, M. V., Problemy Magmatisma i Tektonofizika. Materialy k I Vses. Vulkanolog. Soveshch. (Problems in Igneous Activity with Relation to Tectonophysics. Material for the First All-Union Conference on Volcanology), Yerevan, 1959.

38. Gzovskiy, M. V., Krestnikov, V. N., Nerkrasov, I. L., and Reisner, G. I., "Correlation of Tectonics and Seismicity of the Garm Region, Tadzhik SSR, Parts I-II," Izv. AN SSSR, ser. geofiz., No 8, 12, 1958.

39. Gzovskiy, M. V., Krestnikov, V. N., and Reisner, G. I., "Geological Methods of Determining the Average Gradient of Vertical Tectonic Movements (Changes in Slope) of the Earth's Crust and Some Results of Their Application," Ibid., No 8, 1959.

40. Gurevich, G. I., "Premises of Tectonic Modeling," _Tr. inst. fiz. zemli, AN SSSR_, No 2 (169), 1959.

41. Gurevich, G. I., Nersesov, I. L., and Kuznetsov, K. K., "The Recurrence of Earthquakes as a Corollary to the Regularity of Deformation and Shattering," _Dokl. AN SSSR_, Vol 128, 1959.

42. Delitsin, I. S., "Split (Boundinage) Structures in Quartzite-Marble Rocks of the Southwestern Baikal Region," Ibid., Vol 120, No 5, 1958.

43. Delitsin, I. S. and Rozanov, Yu. A., "Experimental Data on Plastic Deformation in Quartzite," _Izv. AN SSSR, ser. geol._, No 7, 1959.

44. Dolginov, Ye. A., "A Feature of Tectonic Lensing in Sedimentary Sequences," _Nauchn. dokl. vyssh. shkoly, geol.-geogr. nauki_, No 3, 1958.

45. Dolginov, Ye. A., "Structure and Origin of Jurassic Trough in High Caucasus," _Sov. geol._, No 11, 1958.

46. Dolginov, Ye. A., "The Nature of Joints Developed in the Province of the Ancient Caucasian Nucleus," _Izv. vyssh. uch. zav., geol. i razv._, No 7, 1959.

47. Dolenko, G. N., "Faults in the Vienna Basin and Their Part in the Formation of Oil and Gas Fields," _Geol. sb. L'vovsk. geol. ob._, No 5-6, 1958.

48. Zheludev, I. S., "A Study of the Collapse Process in Rocks in Tests for Shock Load Induced by Piezo-electric Transmitter," _Tr. IGEM AN SSSR_, Issue 13, 1958.

49. Zalesskiy, B. V., _Poristoist' Kak Odno Iz Vazhneyshikh Fizicheskikh Svoystv Gornykh Porod. Mater. k II Vses. Petrogr. Soveshch._ (_Porosity as One of the Most Important Physical Properties of Rocks._ Material for the Second All-Union Petrography Conference), Tashkent, 1958.

50. Zalesskiy, B. V., "Methods of Study of Physico-Mechanical Properties of Rocks," _Tr. IGEM AN SSSR_, Vol 13, 1958.

51. Zalesskiy, B. V. and Sanina, Ye. A., "Study of Differential Porosity of the Samara Bend Carbonate Rocks," Ibid.

52. Zalesskiy, B. V. and Timchenko, I. P., "Structural-Lithological Features and Physico-Mechanical Properties of the Soksk Deposit Carbonate Rocks," Ibid.

53. Zaridze, G. M., "Petrostructural Study of Crystalline Rocks in the Baksan Valley, Northern Caucasus," Byull. Mosk. obshch. ispytateley prirody, Vol 33, Issue 2, 1958.

54. Ivakin, B. N., "Modeling the Absorption of Seismic Waves Part I," Izv. AN SSSR, ser. geofiz., No 7, 1958.

55. Ivakin, B. N., "Calculation and Modeling of the Absorption of Seismic Waves Part II," Ibid., No 11, 1958.

56. Ivanchuk, P. P., Opyt Geologo-Strukturnykh Issledovaniy v Severnom Dagestane (Experience of Geologic-Structural Studies in Northern Daghestan), GOSINTI, Moscow, 1957.

57. Kazimirov, D. A., "History of Development and the Formation Mechanism of the Southwestern Ferghana Folds," Geol. sb. L'vovsk geol. obshch., No 5-6, 1958.

58. Kapitsa, A. P., "Dynamics of the Antarctic Ice Cap in the Work Area of the Joint Antarctic Expeditions, AS USSR," Byull. Mosk. obshch. ispytateley prirody, Vol 33, Issue 2, 1958.

59. Klimenko, V. Ya., "Regularities in the Formation and Distribution of Salt Structures in the Dnieper-Donets Trough," Sov. geol., No 6, 1959.

60. Kornevskiy, S. M., "Main Features of Salt Tectonics in the Carpathian Foothills," Geol. sb. L'vovsk. geol. obshch., No 5-6, 1958.

61. Kosygin, Yu. A. and Blank, B. I., "Types of Salt Structures in the Dnieper-Donets Trough," Byull. Mosk. obshch. ispytateley prirody, Vol 33, Issue 6, 1958.

62. Kravchenko, G. G., "An Instance of Plastic Deformation in Limestones in Fault Zones," Izv. AN SSSR, ser. geol., No 3, 1958.

63. Kravchenko, G. G., "The Effect of Physico-Mechanical Properties of Rocks on the Ore Concentration of the Kansk Polymetal Deposit," Dokl. AN SSSR, Vol 123, No 5, 1958.

64. Krimari, A. I. and Zubkov, V. L., "More on Elastic Properties of the Tataria Paleozoic Rocks," Izv. AN SSSR, ser. geofiz., No 6, 1957.

65. Kushnarev, I. P., Lukin, L. I., Rybalov, B. A., Sonyushkin, Ye. P., and Khoroshilov, L. A., "General Regularities in the Localization of Uranium Mineralization, and Main Types of Structures of Hydrothermal Uranium Deposits," Tr. II mezhdun. konferentsii po mirnomu ispol'z. atomnoy energii, Geneva, 1958.

66. Lebedeva, N. B., "On the Formation Mechanism of Clay Diapirs," Sov. geol., No 11, 1958.

67. Lukin, L. A. and Sonyushkin, Ye. P., "Structures of Hydrothermal Uranium Deposits and Some Problems in their Study," Izv. AN SSSR, ser. geol., No 3, 1958.

68. Malinovskiy, Ye. P., "Structural Conditions of Formation of Quartz-Tungsten Veins in the Bukukinsk Deposit," Mat. konf. Mol. Uch. Moskskogo Rayona g. Moskvy, Issue 4, Geology Section, Moscow, 1958.

69. Malinovskiy, Ye. P., Nekotoryye voprosy genezisa pologopadayushchikh kvartsevo-vol'framitovykh zhil Bukukinskogo mestorozhdeniya. Mat. po geol. rudn. mestorozhd. petrograf. mineral. i geokhimii. (Some Problems of the Origin of Gently Dipping Quartz-Tungsten Veins in the Bukinsk Deposit. Material on the Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry), Academy of Sciences USSR Publishing House, 1959.

70. Merlich, G. B., "Tectonic Factors in the Localization of Neogene Mineralization in Trans-Carpathia," Geol. sb. L'vovsk. geol. obshch., No 5-6, 1958.

71. Mikhailov, A. Ye., "Cleavage in Upper Devonian and Lower Carboniferous Deposits of the Atasuy District (Western Part of Central Kazakhstan)," Izv. AN SSSR, ser. geol., No 2, 1957.

72. Nevskiy, V. A., Strukturno-geologicheskoye polozheniye slepykh rudnykh tel nekotorykh redkometal'nykh i svintsovo-tsinkovykh mestorozhdeniy Severnogo Tyan'-Shanya. Mater. k Vses. soveshch. po razrabotke nauch. osnov poiskov slepykh rudnykh tel. Tezisy dokladov. (Structural-Geological Position of Hidden Ores in Some Rare Metal and Lead-Zinc Deposits in Northern Tien-Shan. Material for the All-Union Conference on Working Out the Scientific Fundamentals of Searching for Ore Deposits. Theses of Reports.), State Publishing House of Technical Geological Literature, 1958.

73. Nevskiy, V. A., Osobennosty vnutrennyago stroyeniya, mineralizatsii i istorii razvitiya razlomov nekotorykh rudnykh rayonov sredney azii. (Features of Internal Structure, Mineralization, and History of Development in Some Ore Districts of Central Asia," Ugletekhizdat Publishing House, 1959.

74. Nekrasov, Ye. M., Masshtaby gidrotermal'nogo orudneniya v zavisimosti ot orientirovki zhil otnositel'no sloistosti porod. Mat. po geol. mestorozhd. petrogr. miner. i geokhim. (Scope of Hydrothermal Mineralization Depending on the Orientation of Veins Relative to Stratification. Material on the Geology of Ore Deposits, Petrography, Minerology, and Geochemistry), Academy of Sciences USSR Publishing House, 1959.

75. Nekrasov, Ye. M., "Structural Features of Zambarak Lead-Zinc Vein Deposit, Eastern Karamazar," Zhurn. geol. rudn. mestorozhd., No 3, 1959.

76. Nikiforov, N. A., "The Significance of Lithological and Geologic-Structural Factors in the Distribution of Mercury-Antimony Mineralization in the South Ferghana Deposits," Zakonomernosti razmeshcheniya poleznykh iskopayemykh, Vol II, Moscow, 1957, Publishing House of the Commission on the Regularity of Distribution of Minerals.

77. Nikiforov, N. A., "Relationship Between Small Fractures and the Tectonic Forms and Composition of Paleozoic Sedimentary Rocks," Tr. sredneaziatsk. politekhn. inst. Nov. ser., Issue 6, Tashkent, 1959.

78. Nikolayev, S. V., "Main Types of Dolomites in the Samara Bend and Their Physical Properties," Tr. IGEM AN SSSR, Issue 17, 1957.

79. Nikolayev, S. V., "Some Results of the Study of Fracturing in the Samara Bend Rocks," Ibid., Issue 13, 1958.

80. Nikolayev, S. V. and Vlasova, M. I., "Porosity of Effusive Rocks in Eastern Karamazar and Its Effect on the Localization of Polymetal Mineralization," Vestn. Mosk. gos. univ., No 4, 1959.

81. Nikolayev, N. I., "On the Nature and Morphological Type of Deep-Seated Faults (in the Instance of the Main Kara-Tau Range Fault)," Sov. geol., No 7, 1959.

82. Osokina, D. N., "Gelatine-Glycerine Jelly as Material for Optical Method of Stress Study," Kolloidn. zhurn., 19, No 6, 1957.

83. Pavlov, V. A., O svyazi treshchinnoy tektoniki nekotorykh intruzivov Tsentral'nogo Kazakhstana s tektonikoy vmeshchayushchikh prod. Materialy po geologii rudnykh mestorozhd. pertografii, mineralogii i geokhimii. (Relationship of Fracturing Tectonics in Some Central Kazakhstan Intrusives with the Tectonics of Enclosing Rocks. Material on the Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry), Academy of Sciences USSR Publishing House, 1959.

84. Popov, V. I., "The Centrifugal and Step-Ladder Development of the Lithosphere Shells," Geol. sb. L'vovsk. geol. obshch., No 5-6, 1958.

85. Rezanov, I. A., Tektonika i Seismichnost' Turkmeno-Khorasanskikh Gor (Tectonics and Seismicity of the Turkmen-Khorasan Mountains), Academy of Sciences USSR Publishing House, Moscow, 1959.

86. Riznichenko, Yu. V. and Shamina, O. G., "Elastic Waves in a Solid Stratified Medium as Studied on a Two-Dimensional Model," Izv. AN SSSR, ser. geof., No 7, 1957.

87. Riznichenko, Yu. V. and Shamina, O.G., "Elastic Waves in Layers of Finite Thickness (From the Study on Two-Dimensional Models)," Ibid., No 3, 1959.

88. Rozanov, Yu. A., "Deformation in Barite at High Confining Pressures," Tr. IGEM, Vol 13, 1958.

89. Rozanov, Yu. A. and Delitsin, I. S., "Study of Physico-Mechanical Properties of Ore-Bearing Rocks in Some Ore Regions," Mater. II Vses. Petrogr. Soveshch., 1958.

90. Rozanov, Yu. A. and Delitsin, I. S., "Some Results of Study of the Effect of High Pressures on the Structure ofRocks," Ibid.

91. Silayeva, O. I., "Method of Study of Elastic Properties in Rock Specimens Under Pressure," Izv. AN SSSR, ser. geofiz., No 2, 1959.

92. "Conference on Geophysics (Chronicle)," Ibid., No 7, 1957.

93. Stovas, M. V., "Changeability of the Earth's Rotation as Related to Geotectonics," Geol. sb. L'vovsk. geol. obshch., No 5-6, 1958.

94. Sycheva-Mikhaylova, A. M., "Some Results of Modeling of Deep-Seated Platform Type Block Folds," Sov. geol., No 9, 1958.

95. "Tectonophysical Conference (Resolution)," Sov. geol., Collection 61, 1957.

96. Ushakov, S. A. and Lazarev, G. Ye., "Isostatic Down-warping of the Earth's Crust in the Antarctic, Under the Load of the Ice Cap," Dokl. AN SSSR, Vol 129, 1959.

97. Khain, V. Ye., "Some Problems of the Origin and Classification of Folds in the Earth's Crust," Byull. Mosk. obshch. ispytateley prirody, Vol 32, Issue 5, 1957.

98. Khain, V. Ye., "The Block-Undulation (Block-Fold) Structure of the Earth's Crust," Ibid., Vol 33, Issue 4, 1958.

99. Kholodov, V. N., "Deformation of Carbonate Rocks," Ibid., Vol 32, Issue 3, 1957.

100. Charushin, G. V., "Tectonic Fracturing of Slightly Deformed Sedimentary Rocks in the Southeast of the Irkutsk Amphitheatre," Ibid., Vol 32, Issue 3, 1957.

101. Cherednichenko, I. I., "Some Regularities in the Distribution of Ore Deposits in the Northern Part of the Saksagan Trough, Krivoy Rog," Stn. k. AN URSR, No 9, 1957 (in Ukrainian).

102. Cherednichenko, O. I., "Regularity in the Trend of Ore Bodies Along the Northern Wing of the Saksagan Trough, Krivoy Rog," Geolog. zhurn., No 1, 1958 (in Ukrainian).

103. Shamina, O. G., "Absorption of Compressional and Transverse Waves in Specimens of Different Form," Izv. AN SSSR, ser. geofiz., No 11, 1959.

104. Shirokova, Ye. I., "Determination of Stresses Active in the Foci of Hindukush Earthquakes," Ibid., No 12, 1959.

105. Shurygin, A. M., "The Formation Conditions for the Southeastern Caucasian Structures," Sov. geol., No 3, 8, 1958.

106. Ez, V.V., "On the Part of Linear Flexing of Strata and of Intra-Layer Redistribution of Material in Concentric Folding," Byull. Mosk. obshch. ispytateley prirody, Vol 33, Issue 4, 1958.

107. Ez, V. V., "Some Regularities in the Formation Mechanism of Concentric Folding," Geol. sb. L'vovsk. geol. obshch., No 5, 6, 1958.

108. Ez, V. V., "Tectonic Features in the Province of Deep Foci Earthquakes in East Carpathians," Izv. AN SSSR, ser. geofiz., No 12, 1959.

109. Eygenson, M. S., "Solar Activity, Geodynamics, and Geotectonics," Ibid.

110. Beloussow, W. W., "Einige allgemeine Fragen der Tektonik an der Nahtstelle zwischen Krim und Kaukasus (im Zusammenhang mit der Frage der Entstehung der Faltung)," Berlin, Geologie, Jahrg. 7, Heft 3-6, 1958.

111. Belousov, V. V., "Some Rules Governing the Development of the Earth's Crust," Endeavour, XVII, No 68, 1958.

112. Belousov, V. V., "On Some Problems of Geotectonics," Joun. Geol. Soc. Japan. LXIV, No 749, 1958.

113. Belousov, V. V., "Les Divers Types de Plissemants et Leurs Modes de Formation," Revye de Geographie, Physique et de Geologic Dynamique, (2) Vol II, fasc. 2, Paris, 1959.

114. Belousov, V. V., "Types of Folding and Their Origin," International Geology, Review, No 2, 1959.

115. Belousov, V. V., "Fundamental Features of the Structure and Development of Geosynclines," UGGJ, Assoc. Seism. et de Physique de l'int. de la Terre, Publ. Bureau Centrale seism. fasc. 20, Toulouse, 1959.

116. Gzovskii, M. V., "Tectonophysical Foundation for Geological Criteria of Seismicity, I and II," Bull. Ac. Sciences of the USSR, Geophysics, Ser. No 2-3, 1957, Pergamon Press.

117. Gzovsky, M. V., "The Use of Scale Models in Tectonophysics," Intern. Geology Review, Vol 1, 4, Washington, 1959.

118. Gzovski, M. V., "The Modelling Method in Tectonophysics," Nat. Research Council of Canada, technical translation No 806, Ottawa, 1959.

119. Gzovsky, M. V., "Method of Modelling in Tectophysics," UGGJ Ass. de Seism. et de Phys. de l'inter. de la Terre, Serie A Travaux scientifiques, Fass. 20, Toulouse, 1959.

120. Mjackin, V.I., Riznicenko, Yu. V., "Seismoakustische Methoden fuer die Untersuchung des Spannungszustaudes Gesteinen," Freiberg, 1958.

VI. ABSOLUTE AGE

In recent years, the work of determining the absolute age of rocks has been especially intensively developed in the several institutes of the AS USSR, in the Academies of Union Republics, at some affiliates of the Academy, and in a number of local scientific research institutions.

All work in this field has been and is now proceeding according to a master plan. In order to unify the geochronological research conducted in various laboratories and to direct them toward a common goal, a Commission for the Determination of the Absolute Age of Geologic Formations has been created at the Section of Geological-Geographic Sciences (OGGN), Academy of Sciences USSR.

This Commission has set up the following basic projects:

1. A domestic geologic time scale, in absolute figures.
2. Dating of main tectonic-igneous stages in geo-synclinal zones of the USSR, in absolute figures.
3. Determining the age of secondary processes substantially affecting the original composition of the magmatic medium.
4. Determining the absolute age of ore deposits.
5. Working out in cooperation with petrographers and regional geologists, of a stratigraphic scale for pre-Cambrian formations of the USSR.

Among the diverse tasks completed recently in the Soviet Union, the following should be particularly noted:

A study of the absolute age determination of sedimentary and metamorphic rocks by the argon method, using glauconite (AS Georgian SSR, Daghestan Affiliate AS USSR and All-Union Geological Institute [VSEGEI]) and phyllitic meta-shales of different age (IGI AS USSR). The results of the absolute age determination for sedimentary rocks were in fair agreement with geological concepts. Experimental study has demonstrated a very important in this respect shift in the isotope ratio of the decay products of uranium and thorium, as an effect of physical and chemical factors (Radium Institute, AS USSR [RIAN]). The occurrence and mobility of radiogenous and non-radiogenous lead isotopes has been studied (RIAN SSSR, Geochemistry Institute AS USSR [GEOKHI AN SSSR], and Moscow State University [MGU]. The carbon method of the age determination has been mastered (RIAN SSSR and GEOKHI AN SSSR).

The use of potassium and sodium in ammonia-oxygen flame for the purposes of photometry (Institute of Geological Sciences [IGN] AS Georgian SSR). A method of isotope

analysis of small amounts of lead (MGU); the determination of o in marine sediments for an estimate of the sedimentation rate (RIAN USSR, GEOKHI AS USSR); the strontium method is being worked out in LAGED AS USSR, IGEM AS USSR, IGI AS USSR, and GEOKHI AS USSR.

Of interest is the experiment in determining the age source material in sandstones and shales, which is very important for paleogeographic maps (RIAN USSR); the development of new methods of the age determination, the calcium (VSEGEI) and x-ray spectrum (IGEM AS USSR); the age determination for meteorites, by the lead method, was done at the RIAN SSSR. A pyrochemical method has been worked out for determining the lead content and its isotope composition in iron meteorites, whereby the isolation of some 65-80% lead is possible for samples with a very small content of it (10^{-8}g/g). It has been shown that the lead concentration in the Sikhote-Alin' and Chinge meteorites is of the order of 3×10^{-8} g/g, while it is greater by one order, in the Hanbury and Diablo Canyon meteorites. Sulfide inclusions from the Sikhote-Alin' and Chinge meteorites contain $n \times 10^{-6}$ g/g lead.

The results of study of the lead isotope content in the Diablo Canyon meteorite turned out to be similar to those obtained earlier by Patterson for the same meteorite and corresponding to the theoretical concepts of "primordial" lead in the solar system. A quite different lead isotope content has been obtained for the Sikhote-Alin', Chinge, and Hanbury meteorites -- close to that of the present terrestrial lead. The results obtained suggest the possibility of a different origin of these meteorites. Uranium, lead, and its isotope content were determined for six different tektites. The uranium content varies in the range of 2×10^{-6} -- 3×10^{-6} g/g; the lead content is 2×10^{-6} -- 8×10^{-6} g/g. The isotope lead content is similar to that in terrestrial sedimentary rocks (RIAN SSSR).

1. Main Results of the Studies.

The period 1957-1959 witnessed a further development of scientific research on the determination of the absolute age for rocks of the Soviet Union, and an accumulation of numerical data in active geochronological laboratories.

The work of the absolute age determination was continued for rocks and minerals of the Urals, Bashkiria (Ural and Bashkir Affiliates of AS USSR), Karel'a, Kola Peninsula, Sayan, Antarctic, China, and Finland (LAGED AS USSR and RIAN USSR); pre-Cambrian deposits of the Ukraine (IGN AS USSR, GEOKHI AS USSR, RIAN USSR, MGU, and VSEGEI; rocks of Central and Northern Kazakhstan (IGN AS Kazakh SSR, RIAN

USSR), of the Caucasus (IGEM AS USSR, GEOKHI AS USSR, IGN AS Georgian SSR, Armenian SSR, Azerbaydzhan SSR, and the Daghestan Affiliate AS USSR), Trans-Baikalia, and far East (VSEGEI).

The VNII-I (Magadan) continued the work on determination of the absolute age of granitoids in the region of the Yana-Kolyma and Chukotsk geo-synclines.

2. <u>The Urals and Bashkiria.</u>

The absolute age data in the Urals were used in identifying the following intrusive stages corresponding to the orogenic phases: the Archaean (1900-2100 million years); Lower Proterozoic (1000-1150 million years old); Lower Paleozoic (440-500 million years old); Middle Paleozoic (320-360 million years old); and Upper Paleozoic (240-270 million years old).

The presence of Mesozoic volcanics (165 million years) also has been established, with the Argon method affording the determination of the absolute age of metamorphic formations and of the metamorphism. The data so obtained suggest the absence in the Urals of a general equalizing metamorphism; they also show that the Ural metamorphics are of different ages and belong to different geologic epochs. Metamorphic alterations are well synchronized with igneous epochs.

Good progress in the determination of the absolute age for igneous and metamorphic rocks has been made by the Bashkiri Affiliate AS USSR. A Carboniferous age has been established for a number of massifs of microcline granodiorites, granodiorites, and granosyenites in the Southern Urals and Mugodzhary, along with a number of pegmatite veins and of certain types of "augengneiss" and migmatites. The absolute age data made it possible to postulate a wide development of Carboniferous metamorphism connected with large intrusions, 210-265 million years old, which is in fair agreement with geologicalideas. The Suunduk and Adamovsk massifs have been recognized as the age reference bodies for the Carboniferous. A Silurian age (335-345 million years) has been established for the three older granodiorite massifs, two of which have been designated as the Silurian age reference bodies. An Ordovician age (380-411 million years) has been established for quartz-muscovite veins cutting the Maksyutovsk rocks of the Ural-Tau range. As a result of these investigations, the first variant of a geochronological scale has been compiled for the eastern rim of the Russian platform, the Southern Urals, and Mugodzhary - for the Proterozoic, Rhiphean, and a part of the Paleozoic; in addition, there looms the

necessity of moving the lower boundary of the Carboniferous, back 45-50 million years, as compared with the 1950 scale.

3. The Baltic and the Ukrainian Crystalline Shields.

The results obtained for Karel'a, the Kola Peninsula, and Finland are summarized in the capital work of A. A. Polkanov and E. K. Gerling, Geokhornologiya Baltiyskogo shchita po dannym radiologicheskikh metodov opredeleniya vozrasta (Geochronology of the Baltic Shield from the Radiological Data of Age Determination), in which A. A. Polkanov presents a quite novel concept of the geologic history of that segment of the earth-crust. The argon method data suggest four major cycles of sedimentation and metamorphism for the eastern part of the Baltic shield. The orogenic movements were accompanied by five to six acid intrusive cycles. Theintrusive activity terminated prior to 1600-1800 million years ago, i.e., prior to the Proterozoic, with the Lower Proterozic understood in its former meaning of 1000-1500 million years.

The most reliable values are those for the Rapakivi granite of the Hogland epoch, 1640 million years; and for post-Karelian, post-Jotnian Rapakivi granites, 1950 million years.

The most ancient formations in the Baltic shield are certain pegmatites and migmatites whose age is 3000-15,000 million years.

For Scandinavia, an age of 895-965 million years has been obtained for the Gothokarelids and 1090-1005 million years for the Svenofennids, which is less than the age of the Rapakivi and post-Karelian and Svenofennian granites of Finland and Karelia, thus suggesting different ages for the two (three) cycles.

The differentiation of the Ukrainian pre-Cambrian went on in the Institute of the Ukrainian Academy of Science, RIAN USSR, and GEOKHI AS USSR. The many numerical data obtained will constitute the basis of an absolute age scale for post-Rhiphean deposits.

The Radium Institute, AS USSR has at its disposal data on the absolute age of rocks which form the complex group of the Dnieper migmatites.

The oldest age of over 3000 million years has been assigned to meta-amphibolite type rocks. A series of basic granitoids and associated pegmatites, 2700-3000 million years old has been discovered. A long duration has been established for theprocess of formation of the Dnieper granites, accompanied by a wide development of plagiogranites, with the latest known red aplitic granites, 1750 million years old.

Evidence of a younger epoch of regional metamorphism and igneous activity has been discovered in the Bug and Sinyukha area, about 1600 million years old, corresponding to the formation of the Uman' intrusive complex (1500-1600 million years old). The determination was done by the lead isotope and argon methods; considerable loss of argon from micas of metamorphic gneisses has been established, casting a doubt on the possibility of determining the true age of metamorphics by the argon method.

4. The Age Determination for Igneous Rocks of Kazakhstan.

Data were obtained for the absolute age of the Kazakhstan granite intrusions (RIAN USSR).

A geologic time scale has been proposed for the Paleozoic -- considerably different from former concepts.

The age of late-Hercinian (Permo-Carboniferous) intrusions has been established as 260-320 million years.

The age of early Hercinian (Middle Carboniferous) intrusions -- 340-380 million years.

The age of late Caledonian (Lower Devonian-Ordovician) intrustions, 420-480 million years.

The Cambrian -- pre-Cambrian boundary is estimated as being about 650 million years old.

5. The Caucasus.

Geologic Features of the development of the Caucasus.

The results of study of the absolute age of the Caucasian rocks and minerals by the K-Ar method have revealed a complex picture of igneous activity in that structural segment of the Earth's crust.

Groups of extrusive rocks, identified by geologic-geographic study, have been confirmed to considerable extent through determination of their age by radiological methods. The comparatively well-known geologically Caucasian province is at the present time differentiated into a number of structural zones trending chiefly to northwest. The structure of these zones is very diversified and complex.

The absolute age figures obtained for volcanic and partly for metamorphic rocks have made it possible to discern certain general regularities in the geologic structure of the Caucasus.

The oldest extrusive rocks in the Caucasus (of the granitoid group) are intrusions of plagiogranites -- sodium alaskites and pegmatites, corresponding to a final stage of development of the Caledonian geo-syncline or a number of geo-synclines, in the Caucasus.

Relicts of igneous rocks of this stage of development of the Caucasian folded province are known from the Front Range (Peredovoy) zones; granites of the Main Range; the Axial Zone; in the Georgian and Arvin-Somkhit blocks; and apparently in Central Armenia.

The proper geo-synclinal development stages occurred in the Caucasus in the Lower and Middle Paleozoic (the development of Paleozoic series of rocks including the ophiolite formation: ultrabasics and sodium granitoids), in the Mesozoic, and possibly at the Cretaceous-Tertiary boundary.

The post-geo-synclinal, and shallower, downwarping and folding was accompanied by the formation of a series of rocks with a granodiorite-granite-alaskite composition, essentially potassium-bearing.

This geochronologic study has revealed many other features of the evolution of igneous activity for the long (over 400 million years) period of time embracing the Greater Caucasian folding.

6. Tuva.

The Tuva Autonomus Province is a comparatively old folded region characterized by a wide development of Caledonian igneous rocks.

The Laboratory of the All-Union Geological Institute has determined, by the argon method, the age of a number of granite intrusions associated with different phases of Caledonian orogeny; also the age of several effisive bodies.

Caledonian rocks of Tuva are 225-495 million years old.

7. Central Asia.

Central Asia is very interesting as regards the making of a geochronological scale.

Unlike in the Caucasus, the priority here should be given to establishing the absolute age for tectono-igneous structures of different stages.

The foremost task is to determine the sequence in the growth of mountain ranges from north to south.

By now, two control figures for the absolute age have been determined for a muscovite from the Alai range pegmatites: for the Karavshin pegmatite muscovite, the absolute age, as determined by E. K. Gerling, with argon method, is 218 million years; it is 210 million years, as determined at the Daghestan Affiliate of the AS USSR, an average of 214 million years, which corresponds to Upper Carboniferous.

Other figures for the absolute age - 190 million years for brannerite, and 200 million years for thorium titanite - were obtained for minerals from ore bodies in the Kuturtyubinsk massif associated with alkali massifs of the Alai range. Figures of the same order were obtained for the Urusay massif, a continuation of the Kuturtyubinsk massif.

The publishing activity of the Commission for the Determination of Absolute Age consisted in preparing for the press the Trudy of the I, II, III, IV, V, VI, VII, and VIII Sessions, and the Byulleten' of the I, II, III and IV Sessions.

The Trudy of the Commission are a collection of papers read at its annual meetings, containing information on the results of the study of absolute age.

The Byulleten' gives brief information on the more important new data and achievement in the field of the absolute age determination for geologic fomrations, by radioactive methods, both in the USSR and abroad.

Published in the Byulleten' are scientific communications on radiology and on laboratory methods used in the study of minerals in the determination of their absolute age; the results of new determination obtained both in the USSR and abroad; reviews in the field of geochronology; and the results of foreign study (reports, annotated translations).

BIBLIOGRAPHY

1. Abdulgafarov, K. K. and Cherdyntsev, V. V., "Liberation of Helium and Radioactive Emanations From Minerals," Uch. zap. kazakhstk. univ., Vol 30, Issue 5, pp 21-24; illustr., tables.

2. Akishin, P. A., Nikitin, O. T., Panchenkov, G. M., "New Effective Ion Emitter For Isotope Analysis of Lead," Geokhimiya, No 5, 1957, pp 425-429; illustr., tables. Biblio. 24 titles.

3. Amirkhanov, Kh. I., Brandt, S.V., Bartnitskiy, Ye. N., et al, "Diffusion of Radiogenous Argon In Micas," Tr. geol. inst. (AN SSSR, Dagest. Filial), 1957, Vol 1, pp 188-193; tables, illustr. Biblio. 4 titles.

4. Amirkhanov, Kh. I., Brandt, S. V., and Bartnitskiy, Ye. N., "Some Problems in the Theory of the Argon Method of Determination of the Absolute Age of Rocks," Ibid., pp 175-187; illustr., Biblio. 16 titles.

5. Amirkhanov, Kh. I., Magadayev, K. S. and Brandt, S. B., "The Absolute Age Determination of Sedimentary Minerals with Radioactive Methods," Dokl. AN SSSR, Vol 117, pp 675-677; illustr., tables; Biblio. 5 titles.

6. Amirkhanov, Kh. I., Brandt, S. B., Bartnitskiy, et al, "Thermal Stability of Radiogenous Argon in Dispersed Micas," Tr. geol. inst (AN SSSR, Dagest. Fil.), 1957, Vol 1, pp 194-199; illustr., Biblio. 6 titles.

7. Afanas'yev, G. D., "Cenozoic Igneous Activity in the Caucasus and Some Results of the Absolute Age Determination For Caucasian Rocks by the K-Ar Method," Izv. AN SSSR, ser. geol., 1957, No 6, pp 30-53; illustr., tables; Biblio. 47 titles.

8. Baranov, V. I., "Lead Isochrons for Rocks and the Age of the Earth's Crust," Geokhimiya, No 7, 1957, pp 638-639; illustr., Biblio. 2 titles.

9. Baranov, V. I., "The Age of Meteorites," Ibid., No 2, pp 155-160; illustr., tables; Biblio. 18 titles.

10. Baskakova, Z. A. and Novikov, G. I., "Liberation of Small Amounts of Lead by Reduction Heating in a Vacuum," Ibid., No 7, pp 580-583; tables; Biblio. 9 titles.

11. Belov, I. V., "Igneous Formations of the Sayan-Baikal Mountain Area and the Controversial Problems of their Age Relationship," in the book Trudy IV Sessii Komiss. Po Opredel. Absol. Vozr. Geol. Form (12-14 May 1957), Moscow, Publishing House of the Academy of Sciences USSR, pp 64-72; tables, Biblio. 5 titles.

12. Borovik-Romanova, T. F. and Zmeyenkova, A. V., "Spectroscopic Determination of Potassium in Rocks and Minerals," Ibid., pp 223-236; illustr., tables, Biblio. 16 titles.

13. Burkser, S. S., "New Ways and Methods of Determination of the Absolute Age of Rocks," XI naukova sesiya Prisvyachena 300-richchyu vozz"yednannya Ukrainy Z Rosiyeyu. Tezi dopovidey. Sekts. geol., 1957, p 11 (in Ukrainian).

14. Velikoslavinskiy, D. A., "Outline of the Geological Structure of the Northeastern Part of North-Baikal Highlands and a Correlation of Geological Data With the Absolute Age Figures," in the book Trudy IV Sessii [see No 11 above], pp 55-63, map, table.

15. Vinogradov, A.P., Tugarinova, A. I., Fedorova, and Zykov, S. I., "Age of the Ukrainian pre-Cambrian Rocks," Geokhimiya, No 7, 1957, pp 559-564, tables, Biblio. 6 titles.

16. Vingradov, A. P., Tarasov, L. S., and Zykov, S. I., "Isotope Composition of Ore Lead from Alatai and Kazakhstan," Ibid., No 1, pp 3-22, illustr., tables, Biblio. 21 titles.

17. Vinogradov, A. P., Zadorozhnyy, I. K. and Florenskiy, K. P., "The Inert Gases Content in the Sikhote-Alin' Iron Meteorite," Ibid., No 6, 1957, pp 443-448, illustr., tables, Biblio. 7 titles.

18. Vinogradov, A. P., Tugarinov, A. I., Fedorova, V. A., and Zykov, S. I., "Age of pre-Cambrian Rocks of the Ukraine," Ibid., No 7, 1957, pp 559-565, tables, Biblio. 6 titles.

19. Vladimirova, M. I., "Age of Minerals from the Il'men Mountains, from Radioactive Data," Tr. rad. inst. (AN SSSR), Vol 6, 1957, pp 139-166, illustr., tables, Biblio. 34 titles.

20. Geokhronologicheskaya Shkala SSSR, Vyrazhennaya v Absolyutnom Letoischislenii (Geochronological Scale of the USSR, in Absolute Age), Academy of Sciences USSR Publishing House, Moscow, 1957, 40 pp, tables. (AN SSSR. Voprosy Sovetskoy Nauki)

21. Gerling, E. K., Yashchenko, M. L., and Yermolin, G. M., "The Argon Method of the Age Determination and Its Application," Byull. komiss (AN SSSR) po opred. absol. vozr. geol. formatsiy, Issue 2, 1957, pp 8-27, tables, Biblio. 14 titles.

22. Gerling, E. K. and Shukolyukov, Yu. A., "Determination of Absolute Age by the Isotope Ratio Sr^{87}/Sr^{86} in Sedimentary Rocks," Geokhimiya, No 3, 1957, pp 187-190, illustr., Biblio. 17 titles.

23. Gerling, E. K., "Migration of Helium from Minerals and Rocks," Tr. rad. inst. (AN SSSR), Vol 6, 1957, pp 64-87, tables, Biblio. 46 titles.

24. Gerling, E. K. and Morozova, I. M., "Determination of the Activation Energy in Liberation of Argon from Micas," Geokhimiya, No 4, 1957, pp 304-311, illustr., tables, Biblio. 7 titles.

25. Gerling, E. K., "Helium Diffusion Heat as a Criterion of Fitness of Minerals for the Age Determination by the Helium Method," Tr. rad. inst (AN SSSR), Vol 5, Issue 2, 1957, pp 155-183, illustr., tables, Biblio. 39 titles.

26. Gurvich, I. G. and Khanayev, Yr. I., "Rapid Method of Potassium Determination in Minerals," Izv. AN SSSR, ser. geol., No 4, 1957, pp 104-107, illustr., tables, Biblio. 5 titles.

27. Yermolin, G. M., "Method of Quantitative Separation of Helium-Neon Mixtures," Tr. rad. inst (AN SSSR), Vol 6, 1957, pp 119-138, illustr., tables, Biblio. 7 titles.

28. Zhirov, K. K., Zykov, S. I., Zhirova, V. V., and Stupnikova, N. I., "The Effect of Hydrothermal Alteration Processes on the Age Determination by Radioactive Minerals," Geokhimiya, No 8, 1957, pp 657-665, tables, Biblio. 24 titles.

29. Zhirov, K. K. and Zykov, S. I., "Isotope Composition of Lead from Galena of Northern Karelia Pegmatites," in the book Trudy IV sessii, op. cit., pp 258-265, tables, Biblio. 6 titles.

30. Zhirov, K. K., Zykov, S. I., and Stupnikova, N. I., "The Strength of Bond Between Different Lead Isotopes in the Orthite Structure," Geokhimiya, No 2, 1957, pp 147-154, illustr., tables, Biblio. 12 titles.

31. Zhirova, V. V. and Gokhshteyn, Ya. P., "Quantitative Determination of Lead and Uranium in Minerals, By the Oscillographic Polarography Method," in the book Trudy IV Sessii, op. cit., pp 241-248, illustr., tables, Biblio. 3 titles.

32. Zhirova, V. V., Zykov, S. I., and Tugarinov, A. I., "Age of the Slyudyanka Region Pegmatites," Geokhimiya, No 7, 1957, pp 592-599, tables, Biblio. 12 titles.

33. Zadorozhnyy, I. K. and Bykovskiy, N. N., "Age of Rock by the Rubidium-Strontium Method," in the book Trudy IV Sessii, op. cit., pp 266-269, tables, Biblio. 3 titles.

34. Zykov, S. I. and Stupnikova, N. I., "Isotope Analysis of Lead Without a Preliminary Chemical Processing of the Mineral,"Geokhimiya, No 5, 1957, pp 430-434, tables, Biblio. 4 titles.

35. Zykov, S. I. and Stupnikova, N. I., "Determination of the Lead Isotope Composition," Zhurn. anal. khimii, Vol 12, Issue 4, pp 556-558, tables, Biblio. 1 title.

36. Zykov, S. I., Zhirov, K. K., Zhirova, V. V., and Ivanov, I. B., "The Age Determination by Xenotime and Uraninite From the Tedino Lake Pegmatite Vein," in the book Trudy IV Sessii, pp 249-257, Biblio. 9 titles.

37. Ivantishin, M. M. and Polovko, N. I., "Sixth Session of the Commission on the Absolute Age Determination of Geol. Formations," Geol. zhurn. (AN USSR), Vol 17, Issue 3, 1957, pp 96-98 (in Ukrainian).

38. Kapitanov, Yu. T. and Studenikova, Z. V., "Experiment in the Application of Methods With [omission] Count in Determining the Absolute Age of Rocks," Geokhimiya, No 7, 1957, pp 615-620, tables, Biblio. 6 titles.

39. Knorre, K. G. and Studenikova, Z. V., "Sixth Session of the Commission on the Absolute Age Determination of Rocks," Ibid., No 5, 1957, p 435.

40. Kol'tsova, T. V., "Development of a Rapid Argon Micromethod of the Age Determination for Minerals and a Study of Reliable Conditions of its Application," in the book Trudy IV Sessii, op. cit., pp 186-195, Biblio. 5 titles.

41. Komlev, L. V., "Geochemistry of Radioactive Elements in the Northern Karelia Pegmatite Field in Connection with the Age of the Belomorian Intrusions," Tr. rad. inst (AN SSSR), Vol 5, Issue 2, 1957, pp 230-255, tables, Biblio. 38 titles.

42. Komlev, L. V., Danilevich, S. I., and Ivanova, K. S., "The Age of Geological Formations in the Southwestern Part of the Ukrainian pre-Cambrian," Geokhimiya, No 7, 1957, pp 566-572, tables, Biblio. 4 titles.

43. Komlev, L. V., Danilevich, S. I., Ivanova, K. S., et al, "The Age of Some Rare Metal Granite Intrusions in Central Kazakhstan," Ibid, No 8, 1957, pp 647-656, tables, Biblio. 15 titles.

44. Krylov, A. Ya., Baranovskaya, N. V., and Lovtsyus, G. P., "The Age of Some Terskey-Alatau Range Intrusions and the Value of Geochemical Processes in the Age Determination by the Argon Method," in the book Trudy IV Sessii, op. cit., pp 22-33, tables, illustr., Biblio. 4 titles.

45. Malkhasyan, E. G., "Data on the Absolute Age of the Tsava Intrusion," Dokl. AN SSSR, Vol 26, No 4, 1957, pp 219-220.

46. Mtvralashvili, G. and Arutyunova, M., "Determination of Geologic Age of Lead Ore by the Isotope Analysis Method," Tr. Tbilissk. gos. univ., Vol 62, 1957, pp 223-227, tables.

47. Murin, A. N. and Yutlandov, I. A., "Determination of the Cosmic Age of Meteorites," Geokhimiya, No 1, 1957, pp 33-35, illustr., Biblio. 8 titles.

48. Naydenov, B. M. and Cherdyntsev, V. V., "Change in the Lead Isotope Composition in Natural Objects," Uch. zap. kazakh. gos. univ., Vol 30, Issue 5, 1957, pp 16-20, tables, Biblio. 4 titles.

49. Ovchinnikov, L. N., Shur, A. S., and Panova, M. V., "The Absolute Age of Some Extrusive, Metamorphic, and Sedimentary Formations in the Urals," Izv. AN SSSR, ser. geol., No 10, 1957, pp 3-14, tables, illustr., Biblio. 18 titles.

50. "Determination of Geologic Age by Radioactive Methods," in the book 35 Let rad. inst. im. V. G. Khlopina (Thirty-five Years of the Radium Institute imeni V. G. Khlopin), Academy of Sciences USSR Publishing House, Leningrad, pp 49-55.

51. Pekerskiy, M. A., "Mastering of the K-Ar Method of the Absolute Age Determination for Rocks," Tr. vses. magad. nauch.-issled. inst. za 1956, 1957, pp 31-32.

52. Permyakov, V. M., "Determination of Geologic Age for Some Minerals and Rocks from Khibin and the Northern Areas of the Karelian ASSR by the Lead Method," Tr. rad. inst (AN SSSR), Vol 5, No 2, 1957, pp 203-216, tables, Biblio. 20 titles.

53. Pidoplichko, I. G., "Determination of Geologic Age for Bones of Anthropoid Vertebrates and its Significance in Geochronology," Tr. komissii po izuch. chetvertichn. per. (AN SSSR), Issue 13, 1957, pp 447-453, tables.

54. Polevaya, N. I., "Absolute Age of Some Igneous Complexes of the USSR from the Argon Method Data," in the book Trudy IV Sessii, op. cit., pp 41-54.

55. Polkanov, A. A., "Some Possible Kinks in the Argon Method of Age Determination for Minerals and Rocks," in the book Trudy IV Sessii, op. cit., pp 196-203.

56. Polovinkina, Yu. I., "Comparative Stratigraphy of the pre-Cambrian in the Bug and Middle Dnieper Regions," in the book Trudy IV Sessii, op. cit., pp 141-148, tables.

57. "Radioactive Methods of the Absolute Age Determination for Geologic Formations. Discussion," in the book Trudy IV Sessii, op. cit., pp 275-287.

58. Rubinstein, M. M., "Results of the Absolute Age Determination of Some Igneous Formations in Georgia by the Rapid Argon Method," in the book Trudy IV Sessii, op. cit., pp 151-158, tables, Biblio. 7 titles.

59. Sardarov, S. S., Opredeleniye Soderzhaniya Radiogennogo Argona v Mineralakh i Gornykh Prodakh Metodom Izotopnogo Razbavleniya (Determination of the Radiogenous Argon Content in Minerals and Rocks by the Isotope Dilution Method). Makhachkala, 1957 (AN SSSR, Dagest. Filial), Biblio. 19 titles.

60. Sardarov, S. S., "Preservation of Radiogenous Argon in Microclines," Geokhimiya, No 3, 1957, pp 193-197, tables, Biblio. 7 titles.

61. Semenenko, N. P. and Burkser, Ye. S., "Results of the Study of Age of Ukrainian Rocks," in the book Trudy IV Sessii, op. cit., pp 120-140, tables.

62. "Correlation of the Results of the Absolute Age Determination for Some Regions of the USSR with Geological Ideas. Discussion," in the book Trudy IV Sessii, op. cit., pp 73-80.

63. Starik, I. Ye., "Concluding Speech Before the Fourth Session on the Determination of Absolute Age of Geological Formations, 12-14 May 1955," in the book Trudy IV Sessii, op. cit., pp 288-289.

64. Starik, I. Ye., Sobatovich, E. V., and Lovtsyus, G. P., "The Occurrence of Lead in Natural Formations," Geokhimiya, No 7, 1957, pp 584-591, Biblio. 6 titles.

65. Starik, I. Ye., "Material on the Soviet Time Scale," Byull. komiss. (AN SSSR) po opred. absol. vozr. geol. form., Issue 2, 1957, pp 5-7.

66. Starik, I. Ye., Starik, F. Ye., Avdzeyko, G. V., et al, "Certain Data on the Absolute Age of pre-Cambian Formations," in the book Trudy IV Sessii, op. cit., pp 95-119, tables, Biblio. 13 titles.

67. Starik, I. Ye. and Sobotovich, E. V., "Lead in Natural Formations and its Isotope Composition," Izv. AN SSSR, ser. geol., No 9, 1957, pp 81-85, illustr., tables, Biblio. 2 titles.

68. Starik, I. Ye., "Present Status of Radioactive Methods of the Absolute Age Determination," in the book Trudy IV Sessii, op. cit., pp 8-13.

69. Starik, I. Ye. and Melikova, O. S., "Capacity for Emanation in Minerals," Tr. rad. inst. (AN SSSR), Vol 2, Issue 2, 1957, pp 184-202, illustr., tables, Biblio. 11 titles.

70. Studenikova, Z. V. and Knorre, K. G., "The Age of the North Caucasian Granites," Geokhimiya, No 7, 1957, pp 573-579, tables, Biblio. 8 titles.

71. Tugarinov, A. I., Orlova, L. P., Zykov, S. I., and Chapukhin, M. S., "Forms of Occurrence of Lead in Pitchblende in Connection with the Determination of Absolute Age of Minerals," in the book Trudy IV Sessii, op. cit., pp 204-213, tables, Biblio. 8 titles.

72. Favorskaya, M. A., "Geologic Data on the Age of Young Extrusive Rocks in the Pomor'ye and Their Correlation with the Absolute Age Data," in the book Trudy IV Sessii, op. cit., pp 35-40, illustr.

73. Khamrabayev, I. Kh., "The Absolute Age of Granitoid Intrusions and Post-Igneous Formations in Western Uzbekistan," Izv. AN Uzbek SSR, ser. geol., No 1, 1957, pp 77-87, tables, Biblio. 21 titles.

74. Chalov, P. I., "Determination of the Uranium Isotope Composition (U^{237}, U^{234}) from the Ratio of Alpha- and Beta-Radiations," Tr. inst. geol. (AN Kirgh. SSR), Issue 9, 1957, pp 227-230, tables, Biblio. 4 titles.

75. Cherdyntsev, V. V., Shmonin, L. I., Strashnikov, N. S., and Asanova, O. L., "A Study of the Actinium-Radium Ratio in Minerals," Byull. komiss. (AN SSSR) po opred. absol. vozr. geol. form., Issue 3, 1947, pp 4165, tables, Biblio. 11 titles.

76. Cherdyntsev, V. V. and Isabayev, Ye. A., "Study of Minerals with a Higher Actinium-Radium Ratio," in the book Trudy IV Sessii, op. cit., pp 214-221, tables, Biblio. 1 title.

77. Cherdyntsev, V. V., "The Problem of the Absolute Age Determination for Quaternary Deposits," Tr. komiss. po izuch. Chetvert. Perioda (AN SSSR), Issue 13, 1957, pp 437-446, tables, Biblio. 19 titles.

78. Shcherbakov, D. I., "The Foremost Problems in the Absolute Age Determination for Central Asia," in the book Trudy IV Sessii, op. cit., pp 14-23, tables.

79. Yashchenko, M. L., Afanas'yeva, L. I., and Ovchinnikova, G. V., "Checking the Separation Methods of Sodium and Potassium by Means of Radioactive Tracers," Trudy IV Sessii, op. cit., pp 270-274, tables, Biblio. 3 titles.

80. Abdulayev, O., "The Absolute Age of Some Intrusives in Little Caucasus," Dokl. AN Azerb. SSR, Vol 14, No 3, 1958, pp 207-211, tables, Biblio. 18 titles.

81. Abdulgafarov, K. K. and Cherdyntsev, V. V., "Study of the Liberation of Radioactive Emanations and Helium from Natural Minerals as a Function of Temperature," Izv. vyssh. uch. zav., geol. i razvedka, No 9, 1958, pp 107-117, illustr., tables, Biblio. 9 titles.

82. Avdzeyko, G. V., "The Part of Lead Isotope Analysis in Determining Geologic Age," Tr. rad. inst. (AN SSSR), Vol 8, 1958, pp 198-240, illustr., tables, Biblio. 48 titles.

83. Amirkhanov, Kh. I., Brandt, S. B., Bartnitskiy, Ye. N., et al, "Preservation of Radiogenous Argon in Glauconites," Dokl. AN SSSR, Vol 118, No 2, 1958, pp 328-330, illustr., tables, Biblio. 13 titles.

84. Amirkhanov, Kh. I., Brandt, S. B., and Bartnitskiy, Ye. K., "On the Determination of Absolute Age of K-Feldspars by the Argon Method," Izv. AN SSSR, ser. geol., No 11, 1958, pp 110-112, illustr., tables, Biblio. 4 titles.

85. Amirkhanov, Kh. I., Magatayev, K. S., and Timofeyev, G. I., "Results of the Absolute Age Determination for Sedimentary Rocks in the Daghestan Oil Provinces," in the book Trudy IV Sessii, op. cit., pp 69-76, illustr., tables, Biblio. 16 titles.

86. Afanas'yev, G. D., "Geology of the North Caucasian Igneous Complexes and the Main Features of Associated Mineralization," Tr. inst. geol. urdn. mestorozhd., petrogr., miner. i geokhim., Issue 20, 1958, 139 pp, illustr., tables, Biblio. 77 titles.

87. Afanasiyev, G. D., "New Data on Absolute Age Determination for Rocks and Minerals in Northern Caucasus," Trudy V Sessii komissii po opred. absol. vozr. geol. format., 19-23 Maya 1956, Academy of Sciences USSR Publishing House, Moscow, 1958, pp 44-63, tables and Biblio.

88. Afanas'yev, G. D. and Tseytlin, S. G., "Preliminary Results of the Study of Radioactivity of the North Caucasian Rocks and their Significance in Certain Problems in Petrology," Izv. AN SSSR, ser. geol., No 3, 1958, pp 16-30, tables, Biblio. 22 titles.

89. Afanas'yev, G. D., "Les Lois d'Evolution du Magmatisme des Regions de Plissement al'exemple du Grand Caucase a la lueur des Investigations sur l'Age Absolu," Bull. volcanol., 1958, Ser. 2, t. 19, pp 33-36.

90. Baranov, V. I. and Knorre, K. G., "Methods of Determination of Absolute Age for Geologic Formations (Symposium in Leningrad)," Vest. AN SSSR, No 3, 1958, pp 112-113.

91. Baranov, V. I., Surkov, Yu. A., and Vilenskiy, V. D., "The Presence of Isotope Shifts in Natural Uranium Compounds," Geokhimiya, No 5, 1958, pp 465-472, illustr., tables, Biblio. 6 titles.

92. Baranov, V. I. and Kuz'mina, L. A., "Determination of the Deposition Speed for Bottom Sediments in the Peripheral Part of the Pacific, by Radioactive Methods," in the book Trudy V Sessii, op. cit., pp 321-330, illustr., tables, Biblio. 4 titles.

93. Baranov, V. I., "Latest Data on the Absolute Age Determination of the Earth," Vopr. kosmogonii, Vol 6, 1958, pp 39-55, Biblio. 11 titles.

94. Baranov, V. I. and Knorre, "Seventh Session on the Absolute Age Determination of Geologic Formations (Chronicle)," Geokhimiya, No 5, 1958, pp 506-507.

95. Baranovskaya, N. V., "On the Preservation of Helium in Minerals," in the book Trudy V Sessii, op. cit., pp 311-315, tables, Biblio. 5 titles.

96. Burkser, Ye. S., Kotlovs'ka, F. I., and Zaydi, B. B., "Determination of Absolute Age for Some Stone Meteorites by (vikoristanni osazhdeniya) Potassium by Sodium Tetraphenyl Boride," Geol. zhurn. AN USSR, Vol 18, Issue 2, 1958, pp 90-92, tables, Biblio. 71 titles. (in Ukrainian)

97. Varshav, N. A. and Bortok, G. A., "Determination of the Possibilities of the Radioactive Method in Defining the Zones of Surface Hydrocarbons' Formation," in the book Sbornik Avtorefer. Nauchn Rabot. Zakonch. v 1957 g. (Collection of Reports of Scientific Work Completed in 1957), (Vses. nauch.-issled. geolrazv. neft. inst.) Leningrad, Gostoptekhizdat, pp 227-233, Biblio. 9 titles.

98. Vinogradov, A. P., Tugarinov, A. I., Zykov, S. A., et al, "Age of pre-Cambrian Rocks of the Ukraine," in the book Trudy V Sessii, op. cit., pp 111-133, illustr., Biblio. 7 titles.

99. Vinogradov, A. P., "Isotope Composition of the Earth and Meteorites," Atomnaya energiya, Vol 4, Issue 5, 1958, pp 409-416, illustr., tables.

100. Vinogradov, A. P., Zykov, S. I., and Tarasov, L. S., "The Isotope Composition of Lead Admixture in Ores and Minerals as an Index of Their Origin and the Formation Time," Geokhimiya, No 6, 1958, pp 515-523, tables, Biblio. 11 titles.

101. Voytkevich, G. V., "Single Chronology of the pre-Cambrian," Priroda, No 5, 1958, pp 77-79, tables, Biblio. 13 titles.

102. Vorsin, A. N., "Flame Spectrophotometer for the Determination of Alkali Elements," in the book Trudy V Sessii, op. cit., pp 274-277, illustr., tables.

103. Voskresenskaya, M. N. and Polevaya, N. I., "Initial Data on the Absolute Age Determination for Rocks of the Kursk Metamorphic Series," Byull. komiss. (AN SSSR) po opred. absol. vozr. geol. form., Issue 3, 1958, pp 43-46, tables. Biblio. 7 titles.

104. Gamkrelidze, "Geologic Structure of Georgia and the Application of the Absolute Age Determination Method," in the book Trudy V Sessii, pp 11-21, Biblio. 25 titles.

105. Gerasimovskiy, V. I. and Lebedev, V. I., "The Strontium-Calcium Ratio in Rocks of the Lovozero Massif," Geokhimiya, No 6, 1958, pp 553-557, illustr., tables, Biblio. 5 titles.

106. Gerling, E. K., "Effect of Metamorphism on the Results of the Age Determination on Lead," Ibid., No 4, 1958, pp 287-295, illustr., tables, Biblio. 28 titles.

107. Gerling, E. K. and Morozova, I. M., "Study of Kinetics of the Argon Liberation from Microcline Pyrite," Ibid., No 7, 1958, pp 615-620, illustr., tables, Biblio. 12 titles.

108. Gerling, E. K., Levskiy, L. K. and Afanas'yeva, L. I., "Occurrence of A^{38} in Potassium Minerals," in the book Trudy V Sessii, op. cit., pp 308-312, illustr., tables, Biblio. 2 titles.

109. Gerling, E. K., Yashchenko, M. L., Levskiy, L. K., and Ovchinnikova, G. V., "The Age Determination for Some Micas by the Rubidium-Strontium Method," Geokhimiya, No 6, 1958, pp 535-544, tables, Biblio. 25 titles.

110. Gerling, E. K. and Polkanov, A. A., "The Problem of the Absolute Age of the Baltic Shield," Ibid., No 8, 1958, pp 695-717, illustr., tables, Biblio. 18 titles.

111. Gokhshteyn, Ya. P. and Zhirova, V. V., "Quantitative Determination of Uranium by the Oscillographic Polarography Method," in the book Trudy V Sessii, op. cit., pp 316-320, illustr., tables, Biblio. 1 title.

112. Gurevich, I. G. and Khanayev, Ye. I., "Determination of Potassium in Rocks and Minerals by the Flame Photometry Method," in the book Trudy V Sessii, op. cit., pp 259-273, illustr., tables.

113. Yemikeyav, Kh. R., "The Argon and Lead Method of the Absolute Age Determination for Geologic Formations," Inf. byull. Yuzno-Ural'sk. upr. i nauchn.-tekhn. gorn. obshch., No 3 (5), 1958, pp 40-42.

114. Zhirov, K. K., Baranovskaya, N. V., and Litvina, L. A., "The Absolute Age Determintion by the Helium Method on Monazites," Geokhimiya, No 2, 1958, pp 167-171, tables, Biblio. 15 titles.

115. Zhirov, K. K., Zykov, S. I., Zhirova, Yu. L., and Borshchevskiy, Yu. A., "The Age Determination on Carburans from North Karelian Pegmatites," Nauch. dokl. vyssh. shkol. geol.-geogr. nauki, No 1, 1958, pp 150-154, tables, Biblio. 12 titles.

116. Zykov, S. I. and Stupnikova, N. I., "On the Determination of the Lead Isotope Composition," in the book Trudy V Sessii, op. cit., pp 243-246, tables, Biblio. 1 title.

117. Iokhel'son, S. V., "Liberation of Radon from Rocks at High Temperatures," Izv. AN SSSR, ser. geofiz., No 12, 1958, pp 1451-1457, illustr., tables, Biblio. 2 titles.

118. Kazakov, G. A. and Polevaya, N. I., "Preliminary Data on the Process of a Post-Pre-Cambrian Absolute Geochronological Scale on Glauconites," Geokhimiya, No 4, 1958, pp 296-306, illustr, tables, Biblio. 24 titles.

119. Kashkay, M. A., "Intrusive Rocks of Azerbaidzhan and Their Age Relationship," in the book Trudy V Sessii, op. cit., pp 77-85, tables.

120. Komlev, L. V., Danilevich, S. I., and Kuchina, G. N., "Age of the Dnieper-Tokov, Koroston, and Uman' Granites of the Ukraine (Determined by the Agron Method on Biotite)," in the book Trudy V Sessii, op. cit., pp 186-193, tables, Biblio. 13 titles.

121. Komlev, L. V., "Geochronological Scheme of Differentiation of the Ukrainian pre-Cambrian," Geokhimiya, No 7, 1958, pp 621-631, tables, Biblio. 33 titles.

122. Komlev, L. V., Danilevich, S. I., Ivanova, K. S., et al, "The Age of the Kirovograd-Zhitomir Granites of the Ukraine," in the book Trudy V Sessii, op. cit., pp 159-175, tables, Biblio. 8 titles.

123. Komlev, L. V., Danilevich, S. I., Ivanova, K. S., et al. "The Age of Chernokites and of Chudnovo-Berdichev Granites of the Ukraine," in the book Trudy V Sessii, op. cit., pp 176-185, illustr. tables, Biblio. 4 titles.

124. Kravchenko, G. T., "The Age of Red Biotitic Granites in the Upper Course of River Aldan," Nauchn. soobshch. Yakutsk. fil. Sib. otd. AN SSSR), Issue 1, 1958, pp 49-51, tables.

125. Kravchenko, G. T., "The Age of Monazites from Some Regions of the Soviet Union," Izv. Sib. otd. Akad. Nauk SSSR, Issue 1, 1958, pp 55-63, tables, Biblio. 14 titles.

126. Krylov, A. Ya., Baranovskaya, N. V., and Lovtsyus, G. P., "The Age Determination of Granite Pebbles and Arkosic Sands by the Argon Method," in the book Trudy V Sessii, op. cit., pp 254-258, tables.

127. Murina, G. A., "The Absolute Age Determination by the Argon Method," in the book Trudy V Sessii, op. cit., pp 331-335, tables.

128. Naydenov, B. M. and Cherdyntsev, V. V., "Change in the Isotope Composition of Lead Upon its Liberation from Natural Minerals," Izv. Akad. Nauk, ser. geol., No 5, 1958, pp 40-49, illustr., tables, Biblio. 9 titles.

129. Obruchev, S. V., "The Possibility of Application of the Argon Method in Determining the Absolute Age of Pre-Cambrian Rocks," in the book Trudy Mezhduvedomstvennogo soveshch. po razrabotke unifitsirovannykh stratigraficheskikh skhem Sibiri, 1956. Dokl. po stratigrafii dokembriyskikh otlozheniy (Works of the Interdepartmental Conference on Developing a Unified Stratification Chart of Siberia, 1956. Report on the Stratification of the Pre-Cambrian Deposits), Publishing House of the Academy of Sciences USSR, Moscow-Leningrad, 1958, pp 139-143, tables.

130. Ovchinnikov, L. N., "The Absolute Age Determination of the Uralian Ore Deposits," Geokhimiya, No 6, 1958, pp 545-552, tables, Biblio. 14 titles.

131. Pekarskaya, T. B., "Sixth Session of the Commission on Absolute Age Determination of Geological Formations at the Section of Geological-Geographic Sciences (OGGN) of the Academy of Sciences, Sverdlovsk, May 1957," Izv. AN SSSR, ser. geol., No 1, 1958, pp 115-117.

132. Polevaya, N. I. and Murina, G. A., "The Effect of Some Superimposed Processes on the Results of Determination of Age by the Argon Method," in the book Trudy V Sessii, op. cit., pp 247-253, tables.

133. Polevaya, N. I., Murina, G. A., Sprintsson, V. D. and Shukolyukov, Yu. A., "The Age of Rocks in the Ukrainian Crystalline Massif, from the Argon Method Data," in the book Trudy V Sessii, op. cit., pp 146-158, tables.

134. Polevaya, N. I., Titov, N. Ye., Belyayev, V. S. and Sprintsson, V. D., "Application of the Calcium Method in Determining the Absolute Age of Sylvites," Geokhimiya, No 8, 1958, pp 718-726, illustr., tables, Biblio. 14 titles.

135. Polkanov, A. A., and Gerling E. K. and Rb-Sr and Age of Precambrian of USSR. Trans. Amer. Geophys. Union, 1958, Vol 39, No 4, pp 713-715. tables, Biblio. 9 titles. [Sic -- authors and title]

136. Polovinkina, Yu. I., "History of the Development of Igneous Activity in the Ukrainian Crystalline Massif," in the book Trudy V Sessii, op. cit., pp 134-145, tables.

137. Ravich, M. G., "Absolute Age of pre-Cambrian Rocks in Central Sector of Eastern Antarctic," Inform. byull. inst. geol. arktiki (Ministry geol. i okrany nedr SSSR), No 1, 1958, pp 31-33.

138. Ramazanzade, M. G. and Rostomyan, P. I., "Estimate of Time Required for the Formation of Deposits in Determining the Age of Oil," in the book Annotatsya dokladov. Itogovaya sessiya professorsko-prepodavatel'skogo sostava po nauchno-Issledovatel'skoy rabote (Annotation to Reports.

Preparatory Session of the Teaching Staff on Scientific-Research Work), (Azerb. industr. inst. imeni M. Azizbekova), Baku, 1959.

139. "Resolutions of the Fifth Session of the Commission on Determination of Absolute Age of Geologic Formations," in the book Trudy V Sessii, op. cit., pp 362-367.

140. Rubinstein, M. M., Grigor'yev, I. G., Gel'man, O. Ya, et al, "On the Method of Obtaining the Momomineral Fraction for Determining the Absolute Age of Rocks by the Argon Method," Izv. AN SSSR, ser. geol., No 6, 1958, pp 95-100, illustr., Biblio. 6 titles.

141. Rubinstein, M. M., "New Data on the Absolute Age of Igneous Rocks in Georgia," in the book Trudy V Sessii, op. cit., pp 27-43, tables, Biblio. 4 titles.

142. Savel'yev, B. A., "Determination of the Age of Glaciated Islands of the Arctic (from Foreign Data)," in the book Problemy Severa (Arctic Problems), Issue 1, Publishing House of the Academy of Sciences USSR, Moscow, 1958, pp 341-345.

143. Sardarov, S. S., "Improved Method of Isotope Dilution in Determining the Radiogenous Argon Content in Geologic Formations," in the book Trudy V Sessii, op. cit., tables, illustr., Biblio. 6 titles.

144. Semenenko, N. P., "Problems of pre-Cambrian Geochronology in Africa," Byull. komiss. (AN SSSR) po opred. absol. vozr. geol. form., Issue 3, 1958, pp 33-42, tables.

145. Semenenko, N. P., Burkser, Ye. S., and Ivantishin, M. N., "The Age Determination for Slaty Shales and Phyllites," Ibid., pp 47-48.

146. Semenenko, N. P., Burkser, Ye. S., and Ivantishin, M. N., "Comparative Characteristics of the Age of Rocks in the Ukrainian Crystalline Massif," in the book Trudy V Sessii, op. cit., pp 86-110, tables.

147. Sobotovich, E. V., "Liberation of Lead from Natural Formations," Byull. komiss. (AN SSSR) po opredel. absol. vozr. geol. form., Issue 3, 1958, pp 52-53, Biblio. 5 titles.

148. Starik, I. Ye., Shcherbakov, D. I., and Afanas'yev, G. D., "The Absolute Geochronological Table for the USSR," Ibid., pp 5-32, tables.

149. Starik, I. Ye., "Closing Speech (at the Fifth Session of the Commission on Determination of Absolute Age of Geologic Formations," in the book Trudy V Sessii, op. cit., pp 356-361.

150. Starik, I. Ye., Starik, F. Ye., Yelizarova, A. N., "The Significance of Leaching Capacity of Various Radioelements in the Age Determination by the Lead Method," Ibid., pp 221-232, illustr., tables.

151. Starik, I. Ye., Starik, F. Ye., and Petryayev, Ye. P., "The Problem of AcX Leaching Out of Minerals," Byull. komiss. (AN SSSR) po opred. absol. vozrasta geol. form., Issue 3, 1958, pp 60-61, tables, Biblio. 1 title.

152. Starik, I. Ye., Starik, F. Ye., and Mikhaylov, B. A., "The Shift in Isotope Ratios in Natural Formations," Geokhimiya, No 5, 1958, pp 462-464, tables, Biblio. 11 titles.

153. Starik, I. Ye., Kuznetsov, Yu. V., Grashchenko, S. M., and Frenklikh, M. S., "The Ion Method the Age Determination for Marine Sediments," Ibid., No 1, 1958, pp 3-13, illustr., tables, Biblio. 13 titles.

154. Starik, I. Ye., Melikova, O. S., Bakhmatov, B. A., and Zakharov, V. G., "The Method of Study of the Emanation of Radon, Thoron, and Actinon as a Function of Temperature," Byull. komiss. (AN SSSR) po opred. absol. vozrasta geol. form., Issue 3, 1958, pp 49-51, tables, Biblio. 5 titles.

155. Starik, I. Ye., "New Works on the Determination of Absolute Age of Geologic Formations (VII Annual Session)," Vest. AN SSSR, No 8, 1958, pp 120-121.

156. Starik, I. Ye., Sobotovich, E. V., Avdzeyko, G. V., and Lovtsyus, A. V., "New Method of Determining the Isotope Composition of Lead from Rocks," in the book Trudy V Sessii, op. cit., pp 233-242, illustr., tables, Biblio. 7 titles.

157. Starik, I. Ye., Sobotovich, E. V., and Lovtsyus, S. P., "Heterogeneity of Lead in Natural Formations," Byull. komiss. (AN SSSR) po opred. absol. vozrasta geol. form., Issue 3, 1958, pp 54-59, tables, Biblio. 6 titles.

158. Starik, I. Ye. and Litvina, L. A., "Application of the Leaching Method to Determine the Fitness of Samples in the Argon Method of Age Determination," Geokhimiya, No 2, 1958, pp 163-166, tables, Biblio. 3 titles.

159. Starik, I. Ye., Petrshak, K. A., Shats, M. M. et al, "The Distribution of Uranium and its Isotope Composition in Meteorites," in the book Trudy V Sessii, op. cit., pp 336-345, tables, Biblio. 14 titles.

160. Starik, I. Ye., "The Present Status of Radioactive Methods of the Absolute Age Determination for Rocks," in the book Trudy V Sessii, op. cit., pp 5-8.

161. Tugarinov, A. I., Zykov, S. I., and Zmeyenkova, A. V., "The Age of Some Lead Ore Deposits in the Caucasus," in the book Trudy V Sessii, op. cit., pp 64-68, tables, Biblio. 3 titles.

162. Tugarinov, A. I., Zykov, S. I., and Orlova, L. P., "The Forms of Occurrence of Lead in Radioactive Minerals and the Methods of Their Age Determination," in the book Trudy V Sessii, op. cit., pp 346-355, illustr., tables, Biblio. 4 titles.

163. Usenko, I. C., Bernads'ka, L. G. and Kotlovs'ka, F. I., "New Data on the Absolute Age Determination of Post-Proterozoic Effusive Rocks," Geol. zhurn. akad. nauk USSR, 1958, Issue 5, Vol 18, pp 83-88, tables.

164. Cherdyntsev, V. V., "Separation of Radioelements and the Products of Their Decay, from Natural Formations," Byull. komiss. (AN SSSR) po opred. absol. vozrarta geol. form., Issue 3, 1958, pp 65-67.

165. Shukolyukov, Yu. A., "On the Changeability of the Strontium Isotope Content in Nature (Report)," Ibid., pp 62-64, Biblio. 6 titles.

166. Shukolyukov, Yu. A., "New Equipment for the Determination of Argon in Rocks," in the book Trudy V Sessii, op. cit., pp 289-295, illustr., tables.

167. Shcherba, G. N. and Ivanov, A. I., "The Age of Certain Rare Metal Granite Intrusions in Central Kazakhstan," Geokhimiya, No 6, 1958, pp 607-609, tables, Biblio. 9 titles.

168. Scerbakov, D. J., Geochronologicky vyzkum provadeny v SSSR metodami urcovani absolutniho stari. - Vest. Ustred. ustavu geol., 1958, rocn. 33, c. 1, s. 1-11.

169. Yashchenko, M. L., Ovchinnikova, G. V., and Afanas'yeva, L. I., "On the Methods of Determination of Akali Metals," in the book Trudy V Sessii, op. cit., pp 296-307, tables, Biblio. 3 titles.

1959 BIBLIOGRAPHY

170. Amirkhanov, Kh. I., Brandt, S. V., Bartnitskiy, Ye. N., et al, "Diffusion of Radiogenous Argon in Micas," Dokl. AN SSSR, Vol 125, No 6, 1959, pp 1345-1347, illustr., tables, Biblio. 3 titles.

171. Amirkhanov, Kh. I., Brandt, S. B., Bartnitskiy, Ye. N., et al, "The Mechanism of the Argon Loss in Micas," Izv. AN SSSR, ser. geol., No 3, 1959, pp 104-107, illustr., Biblio. 6 titles.

172. Afanas'yev, G. D., "Some Geologic Results of Study of the Absolute Age Determination for Rocks," Ibid., No 9, 1959, pp 12-22, Biblio. 11 titles.

173. Afans'yev, G. D., "Development of Magmatism on the Caucasus on the Light of Absolute Age Determinations," Byull. volcanol., 1959, ser. II, t. 20.

174. Bagdasaryan, G. P., "New Data on the Age of Some Intrusive Massifs of Armenia," Dokl. AN SSSR, Vol 28, No 2, 1959, pp 85-70 [sic], tables.

175. Baranov, V. I. and Knorre, K. G., "Eight Session of the Commission on Determination of the Absolute Age of Geologic Formations (at OGGN AN SSSR, Moscow, 18-22 May 1959," Geokhimiya, No 6, pp 562-563.

176. Baranov, V. I., Surkov, Yu. A., and Vilenskiy, V. D., "On the Presence of Isotope Shifts in Natural Thorium Compounds," Ibid., No 1, 1959, pp 69-75, illustr., tables, Biblio. 11 titles.

177. Baranov, V. I. and Knorre, K. G., "The Absolute Age Determination for Geologic Formations," Vest. AN SSSR, No 9, 1959, pp 100-101.

178. Vershinin, A. S., "Radioactive Equilibrium in Uranium Minerals as an Index of the Time of Their Formation and of the Migration Direction of Radioactive Elements," Tr. Sverdlovsk. gorn. inst., Issue 34, 1959, pp 165-172, Biblio. 6 titles.

179. Vinogradov, A. P., Tarasov, L. S., and Zykov, S. I., "Isotope Composition of Ore Lead in the Baltic Shield," Geokhimiya, No 7, 1959, pp 571-607, illustr., tables, Biblio., 29 titles.

180. Vinogradov, A. P., Devirts, A. L., Dovkina, E. I., et al, "Determination of Absolute Age by C^{14}," Ibid., No 9, 1959, pp 663-668, illustr., tables, Biblio. 8 titles.

181. Winogradov, A. P., Tugarinov, A. J., Zhirova, V. V., u. andr., Ueber das Alter der Granite und Erzvorkommen in Sachsen, Freiberger Forschungsh., 1959, C 57.

182. Volkov, V. P. and Savinova, Ye. N., "The Distribution of Rubidium and the K/Pb Ratio in Rocks of the Lovozero Alkali Massif," Geokhimiya, No 6, 1959, pp 524-529, tables, Biblio. 11 titles.

183. Gel'man, O. Ya., Grigor'yev, I. G., Khutsaidze, A. L., and Chikvadze, V. G., "Some Data on the K-Ar Method of the Absolute Age Determination for Rocks," in the book Vtoraya Zakavkazskaya konferentsiya molodykh nauchnykh sotrudnikov geologicheskikh institutov Akademiy nauk Gruzinskoy SSR, Armyanskoy SSR i Azerbaydzhanskoy SSR

pri uchastii molodykh nauchnykh sotrudnikov Instituta geologii Akademii nauk Turkmenskoy SSR. Tezisy dokladov. (Fifth Transcaucasus Conference of Young Scientific Workers of Geological Institutes of the Academies of Sciences Georgian, Armenian, and Azerbaydzhan SSRs, with Participation of Young Scientific Workers of the Institute of Geology of the Academy of Sciences Turkmen SSR. Theses of Reports), Publishing House of the Academy of Sciences Azerbaydzhan SSR, Baku, 1959, pp 36-37.

184. Gerling, E. K. and Shukolyukov, Yu. A., "Isotope Composition and Content of Xenon in Uranium Minerals," Geokhimiya, No 1, 1959, pp 212-222, illustr., tables, Biblio. 19 titles.

185. Gerling, E. K. and Shukolyukov, Yu. A., "Accumulation of Ar^{38} in Uranium Minerals," Ibid., No 7, 1959, pp 608-618, illustr., tables, Biblio. 26 titles.

186. Gerling, E. K., Shukolyukov, Yu. A., and Makarochkin, V. A., "Determination of the Half-Life Period for U^{238} by the Amount of Xenon in Uranium Minerals," Radiokhimiya, Vol 1, Issue 2, 1959, pp 223-226, tables, Biblio. 31 titles.

187. Yesikov, A. D., Beschastnova, G. S., and Yakovlev, G. N., "Determination of Strontium in Minerals and Rocks, by the Flame Photometry Method," Izv. AN SSSR, ser. geol., No 12, 1959, pp 69-76, illustr., Biblio. 9 titles.

188. Zhirov, K. K. and Chernyshev, I. V., "On Geochemistry of Lead in Devonian Effusives of Central Kazakhstan," Geokhimiya, No 2, 1959, pp 116-123, illustr., tables, Biblio. 13 titles.

189. Zhirov, K. K. and Zykov, S. I., "The Isotope Composition of Lead in Some Central Kazakhstan Ore Deposits," Ibid., No 1, 1959, pp 76-81, tables, Biblio. 10 titles.

190. Kayupov, A. K., "The Age Relationship of Polymetal and Rare Metal Mineralization," Izv. AN Kazakh. SSR, No 1 (34), 1959, pp 40-50, tables, Biblio. 32 titles.

191. Komlev, L. V., Filippov, M. S., Danilevich, S. I., et al, "The Age Data Obtained for Some Granites and Pegmatites from the Middle Dnieper Region, by the Argon and Lead-Isotope Methods," Geokhimiya, No 2, 1959, pp 110-115, tables, Biblio. 12 titles.

192. Krylov, A. Ya., Silen, Yu. I., and Lovtsyus, A. V., "The Age of Granitoids from the North Tien-Shan Zone," Dokl. AN SSSR, No 3, 1959, pp 658-660, tables, Biblio. 5 titles.

193. Krylov, A. Ya. and Silin, Yu. I., "The Time of Metamorphism of Ancient Deposits in the North Tien-Shan Zone," Ibid., Vol 122, No 5, 1958 [sic], pp 889-891, tables, Biblio. 9 titles.

194. Krylov, A. Ya. and Atrashenok, L. Ya., "The Manner of Occurrence of Uranium in Granites," Geokhimiya, No 3, 1959, pp 246-251, tables, Biblio. 10 titles.

195. Krylov, A. Ya. and Silin, Yu. I., "Application of the Argon Method of the Age Determination in the Study of Migration of Terrigenous Sediments," Dokl. AN SSSR, Vol 129, No 3, 1959, pp 642-644, illustr., tables, Biblio. 7 titles.

196. Krylov, A. Ya., "Distribution of Uranium and Thorium on Some Single-Phase Intrusions of the Tien-Shan," Izv. AN SSSR, ser. geol., No 11, 1959, pp 8-14, tables, illustr., Biblio. 10 titles.

197. Lebedev, V. S., "The Absolute Age Determination for the Alakurtti Pegmatite Vein (Northwestern Karelia)," in the book Konfer. molodykh nauchn. sotrudn. IMGRE AN SSSR. Tezisy dokladov. (Conference of Young Scientific Workers of IMGRE, AS USSR. Theses of Reports), Moscow, 1959, pp 14-15.

198. Lugov, S. F., "The Age of the Chukotka Granitoids from the Argon Method Data and from Geologic Observations," Sov. geol., No 5, 1959, pp 142-148, tables, Biblio. 8 titles.

199. Lyubarskiy, K. A., "An Attempt at the Absolute Age Determination for the Moon Formations," Byull. vses. astrn.-gedez. ob-va, No 25, 1959, pp 3-8, tables, Biblio. 4 titles.

200. Malinovskiy, F. M., "The Isotope Composition of Lead from the Podolia Sulfide-Bearing Phosphates," Geokhimiya, No 2, 1959, pp 191-192, tables, Biblio. 5 titles.

201. Mineyev, D. A., "On the Age and Origin of the Slyudyanaya Mountain Pegmatites (Middle Urals)," in the book Konfer. Molodykh, op. cit. [197 above], pp 15-16, tables.

202. Narbutt, K. I., Laputina, I. P., Shuba, I. D., et al, "The Isotope Composition of Ore Lead and the Age of Minerals Carrying V, Th, and Pd from Data of Mass-Spectroscopy and X-ray Spectrum," Tr. inst. geol. rudn. mestorozhd., petrogr., mineral. i geokhimii (AN SSSR), Issue 28, 1959, pp 122-137, illustr., tables, Biblio. 15 titles.

203. Ovchinnikov, L. N., Kelarev, V. V., Panova, M.V., et al, "On the Preservation of Argon in Micas," Geokhimiya, No 8, 1959, pp 204-210, tables, illustr., Biblio. 5 titles.

204. Pekarskaya, T. B., "Review of Scientific Works on the Absolute Age Determination of Rocks in the USSR," Izv. AN SSSR, ser. geol., No 12, 1959, pp 119-122.

205. Polevaya, N. I., "Eighth Session of the Commission on the Absolute Age Determination of Geologic Formations," Sov. geol., No 11, 1959, pp 144-153, illustr., tables.

206. Polovinkina, Yu. Ir., Polevaya, N. I., and Murina, G. A., "The Absolute Age Determination of the Azov Region Rocks, by the Argon Method," Inform. sb. (Vses. nauch.-issl. geol. inst.), No 11, 1959, pp 91-96, Biblio. 5 titles.

207. Rabinovich, Z. A. and Baskova, Z. A., "The Nature of Distribution of Lead in Some Granitoids of the Eastern Trans-Baikal Region," Geokhimiya, No 6, 1959, pp 546-549, tables, Biblio. 1 title.

208. Ramazanzade, M. G. and Rostomyan, P. M., "Physical Method of Estimating the Absolute Age of Sedimentary Deposits," Izv. vyssh. uch. zav., neft' i gaz, No 6, 1959, pp 11-17, tables, Biblio. 6 titles.

209. Rubinstein, M. M., Chakvaidze, V. G., Khutsaidze, A. L., and Gel'man, O. Ya., "The Use of Glauconite in Determining the Absolute Age of Sedimentary Rocks, By the Argon Method," Izv. AN SSSR, ser. geol., No 12, 1959, pp 78-83, tables, Biblio. 16 titles.

210. Rubinstein, M. M., "Geological Interpretation of the Absolute Age Figures Obtained by the Argon Method," in the book Sborn. trudov (AN Gruz. SSR geol. inst.) (Collected Works of Geology Institute, AS Georgian SSR), Publishing House of AS Georgian SSR, Tbilisi, 1959, pp 67-71, Biblio. 10 titles.

211. Semenenko, N. P., "Pre-Cambrian Geochronology in Absolute Figures," Izv. AN SSSR, ser. geol., No 5, 1959, pp 3-15, tables, Biblio. 32 titles.

212. Semenenko, M.P., "Achievements of the Absolute Geochronology Toward the Initial Boundary of Geologic History," Geol. zhurn. (AN USSR), Vol 19, Issue 5, 1959, pp 11-16.

213. Semenov, Ye. I. and Shuba, I. D., "Geologic Age of the Lovozero and Other Alkali Massifs of the Kola Peninsula," Tr. inst. geol. rudn. mestorozhd., petrogr., mineralog. i geokh. (AN SSSR), Issue 28, 1959, pp 138-141, illustr., Biblio. 9 titles.

214. Semenov, P. P., "Mica Pegmatites and the Absolute Age of Post-Jurassic Intrusions in Aldan," Izv. AN SSSR, ser. geol., No 1, 1959, pp 45-49, illustr. tables, Biblio. 9 titles.

215. Starik, I. Ye, Sobotovich, E. V., and Shats, M. M., "On the Age of Tektites," Ibid., No 9, 1959, pp 90-91, Biblio. 8 titles.

216. Starik, I. Ye., Kurbatov, V. V., and Litvina, L. A., "The Effect of Heating on the Structure of Micas and Microcline and the Preservation of Argon in Them," Zap. vses. mineral. ob., Part 88, Issue 6, 1959, pp 724-728, tables, Biblio. 7 titles.

217. Starik, I. Ye., Shats, M. M., and Sobotovich, E. V., "The Age of Meteorites," Dokl. AN SSSR, Vol 123, No 3, 1958, pp 424-426, tables, Biblio. 11 titles.

218. Starik, I. Ye., Ravich, M. G., Krylov, A. Ya., and Silin, Yu. I., "The Absolute Age of the East-Antarctic Platform Rocks," Ibid., Vol 126, No 1, 1959, pp 144-146, tables, Biblio. 3 titles.

219. Starik, I. Ye., Sobotovich, E. V., Lovtsyus, G. P., et al, "Determination of the Lead Content and of its Isotope Composition in Iron Meteorites," Radiokhimiya, No 5, 1959, pp 596-602, tables, Biblio. 6 titles.

220. Tugarinov, A. I., Zykov, S. I., Zhirova, V. V., and Knorre, K. G., "The Age of Oldest Rocks in the Antarctic," Geokhimiya, No 6, 1959, pp 555-556, tables, Biblio. 1 title.

221. Filippov, M. S. and Komlev, L. V., "Uranium and Thorium in Granitoids of the Middle Dnieper Region," Ibid., No 5, 1959, pp 437-448, illustr., tables, Biblio. 16 titles.

222. Firsov, L. V., "The Absolute Age of Some Intrusives from the Kolyma Complex, Northeastern USSR," Kolyma, No 9, 1959, pp 24-26.

223. Chalov, P. I., "The U^{234}/U^{238} Isotope Ratio in Some Secondary Minerals," Geokhimiya, No 2, 1959, pp 165-170, tables, Biblio. 6 titles.

224. Shur, A. S., "The Argon Method of the Absolute Age Determination for Rocks and Minerals," Izv. AN SSSR, ser. geol., No 6, 1959, pp 109-111, illustr.

225. Shcherba, G. N. and Ivanov, A. I., "The Age of Some Hercinian Intrusive Complexes in Central Kazakhstan," Vest. AN Kazakh. SSR, No 12 (177), 1959, pp 66-71, tables, Biblio. 3 titles.

10,059

-END-